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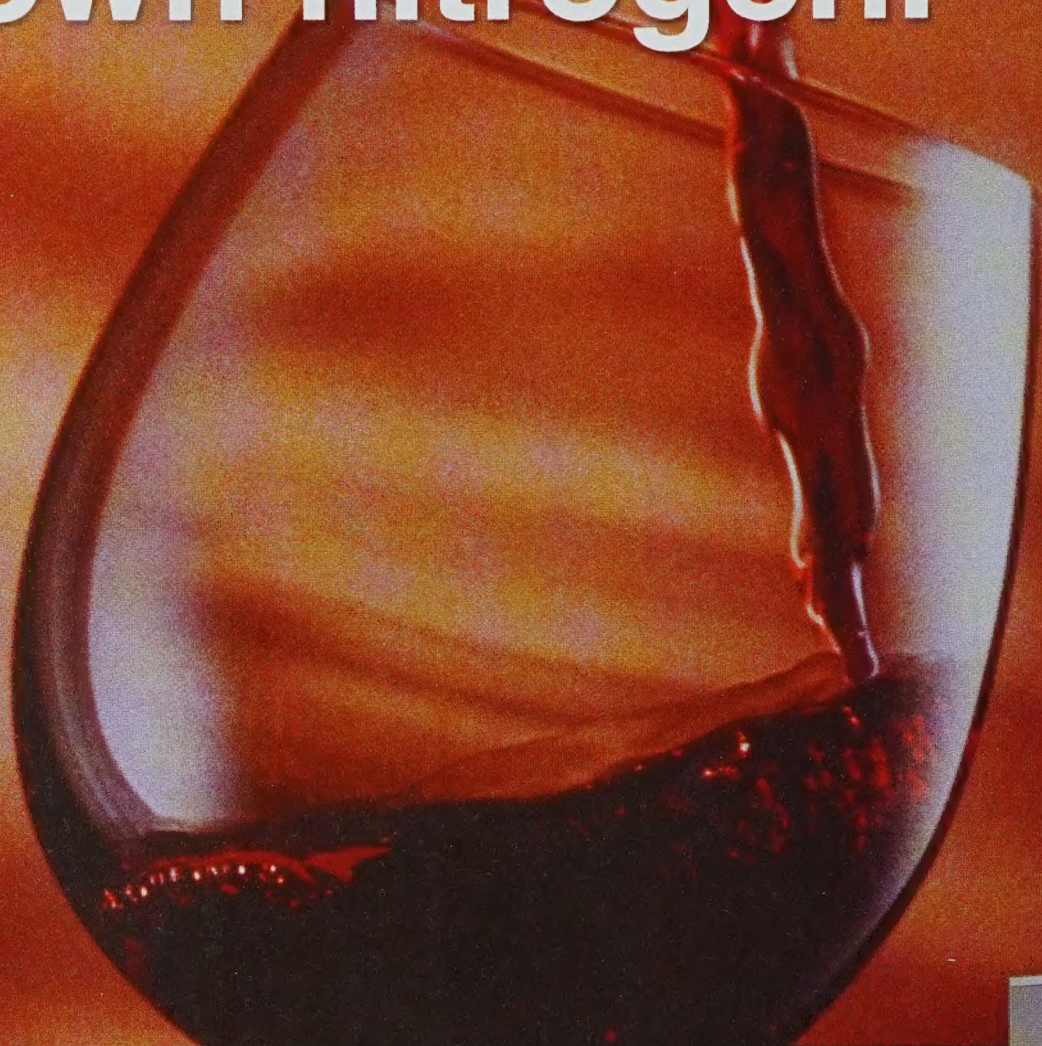
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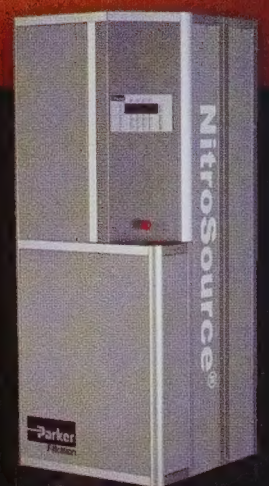


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**16 Forklift raises picking bin to where
grapes are dropped onto a sorting table
at August Cellars (Newberg, OR). Photo
and Cover Photo by Rick Keating.**

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"WHO" AND "WHERE" OF WINE

Geographical Branding

BY J. Scott Gerien,
Dickenson, Peatman & Fogarty
Napa, CA

In journalism, the five Ws — who, what, where, when, and why — are the formula to deliver the full story. To present the full story on wine, this formula also works on a wine label — style (what?), vintage (when?), taste (why?). The focus of this article is on the "who" and the "where," how these factors inter-relate in the branding of wine, and how the "where" as perceived on the label may or may not actually reflect the origin of the wine.

A trademark, or a brand name, represents the "who," the source of the wine. A designation of origin represents the "where," which is the geographical origin of the wine. Seems straightforward, right? Of course, it is not.

In many cases, the division between who and where is simple. RIDGE is a

brand name that represents the producer or the source of the wine. RIDGE wines also feature various appellations of origin on their labels depending upon where the grapes for the wine were grown (Sonoma, Paso Robles, Howell Mountain, Santa Cruz Mountains) and upon compliance with labeling rules for appellations of origin as set forth by the Alcohol and Tobacco Tax and Trade Bureau (TTB). Use of an appellation of origin on a label requires that the wine be derived 75% from grapes from the appellation, and use of an American Viticultural Area requires an 85% origin.

What happens when the brand name also contains a geographical term? This is where things begin to unravel and the relevant laws can create serious complications for the brand owner and for producers and vineyard owners with interests in the use of a geographical term as a designation of origin.

Descriptive use of geographical terms in trademarks

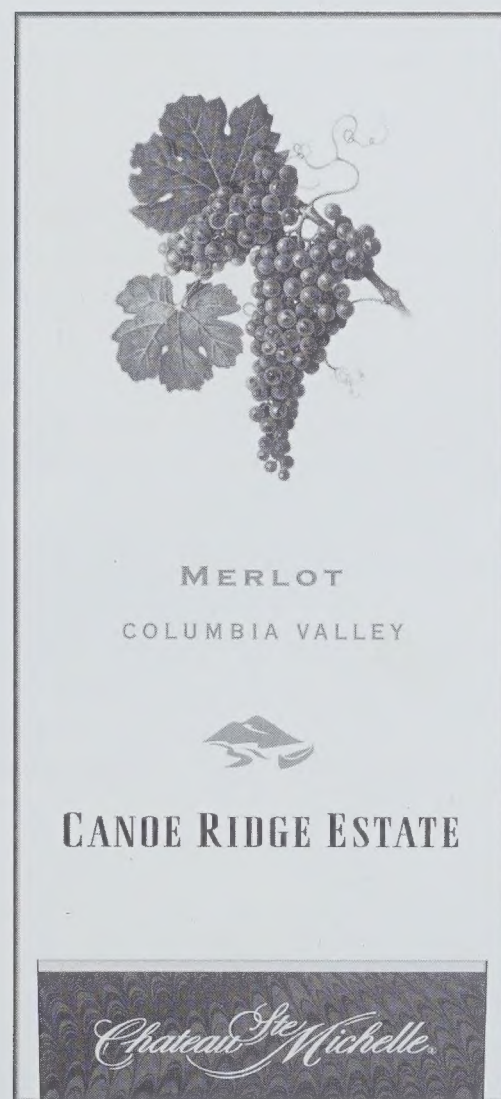
The general rule under trademark law is that a geographical term cannot be exclusively protected as part of a trademark if the geographical term describes the origin of the goods and if consumers would associate the goods under the mark with the place described in the mark. Put another way "Paso Robles" for wine from Paso Robles could not be protected as an exclusive trademark belonging to one

party because consumers would likely believe "Paso Robles" to describe the origin of the wine.

That being said, a geographical designation may be protected as part of a larger composite trademark for wine from the place identified, such as GALLO OF SONOMA. But this does not confer any rights to the term "Sonoma." For instance, Gallo could not prevent the use of the mark GENERATIONS OF SONOMA for wine from Sonoma County.

Thus, to adopt a mark that is primarily geographically descriptive, a designation of origin combined with another non-distinctive or generic term such as "winery," "cellars," or "red," for example, entails accepting the fact that you will have a weak mark and will be unable to prevent others from using the same geographical term in slightly different marks.

This issue arose recently when Santa Barbara Winery complained that



MARKETING

Bronco Wine Company adopted the mark SANTA BARBARA LANDING in conjunction with a label type font similar to that used on the SANTA BARBARA WINERY label.

Whether or not the claim of font similarity has any merit, a claim of infringement is weakened by the fact

that the primary point of similarity between the two marks, "Santa Barbara," cannot be claimed exclusively by any party as a mark. Since Bronco's mark also uses a term different from "winery" in association with "Santa Barbara," there is an arguable point of distinction between the

marks. This limitation to protection is the risk one assumes in adopting a geographically descriptive mark.

Sometimes, such risk is knowingly assumed between parties because of the interest in using the geographical term. The Canoe Ridge area in the Horse Heaven Hills AVA (Washington state) has vineyards owned by Chateau Ste. Michelle and Chalone. By mutual agreement Chateau Ste. Michelle uses the mark CANOE RIDGE ESTATE for wine produced from its vineyard, while Chalone uses the mark CANOE RIDGE VINEYARD (winery in Walla Walla, WA).

"The term 'Canoe Ridge' describes a geographical area where our red wine facility and vineyard is located," explains Lynda Eller, Communications Manager, Chateau Ste. Michelle (Woodinville, WA). "Chateau Ste. Michelle uses 'Canoe Ridge Estate' as a vineyard designation and Chalone uses 'Canoe Ridge' as a brand name."

While the similarity of "Canoe Ridge" in both marks probably leads to some confusion, presumably the value of the geographical significance of Canoe Ridge is sufficiently important for both parties to use it in their respective marks despite the potential risk of confusion.

Where a mark is found to be geographically descriptive of the origin of the goods, however, it may nonetheless still be registered and protected as a trademark where it can be shown to have been exclusively used over time and to have attained a secondary meaning as a trademark in the minds of consumers, as opposed to a designation of origin.

For example, even though the term "California" is geographically descriptive for wine coolers and "cooler" is generic for wine coolers, the term CALIFORNIA COOLER was found to be protectable based on the secondary meaning the composite had acquired as a trademark in the minds of consumers. Thus, the owner of the CALIFORNIA COOLER mark was allowed to prevent others from using the combined descriptive and generic terms CALIFORNIA COOLER due to this acquired distinctiveness. However, this is the exception and secondary meaning is

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generally not easily attained for geographically descriptive marks.

Finally, if a mark contains a geographical term and the wine originates in the place identified by the term, but the primary significance of the term to the general public is not geographical, then the term may be registered as a

trademark for exclusive protection. An example of such a mark is JAMIESON CANYON, which functions as a wine brand for Kirkland Ranch (Napa, CA). Because the term is not generally used or known to the public as a designation of origin for wine, it has been registered as an exclusively protectable trademark.

Deceptive and geographically misdescriptive use of geographical terms

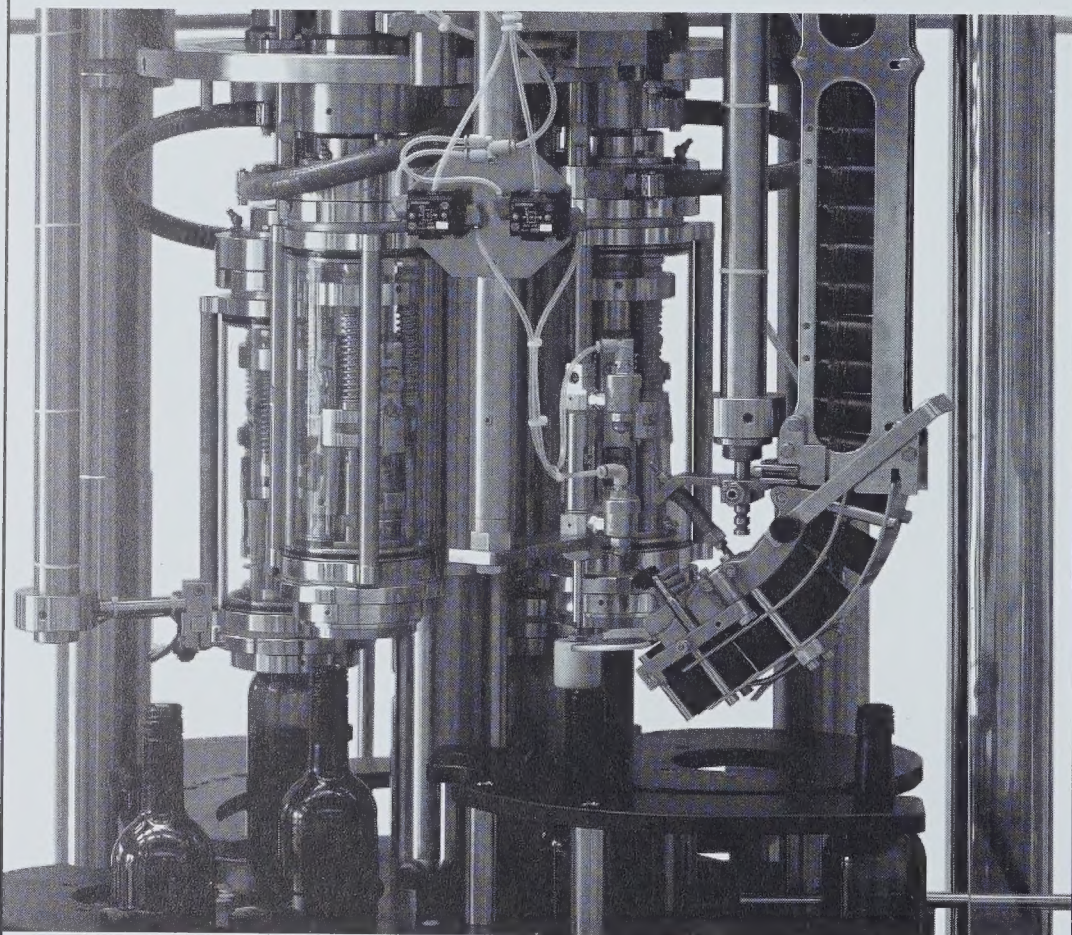
On the opposite side of the trademark coin from geographical descriptiveness are the issues of geographical deceptiveness and geographical misdescriptiveness, both of which are judged by the same legal standard. A mark is found to be geographically-deceptive or geographically misdescriptive when it consists of a geographical term and is used on a product not from the place identified by the term, such that consumers would purchase the product based on the misbelief that the product was from the area identified.

Where a trademark is found to be deceptive or geographically misdescriptive, it cannot be registered. The trademark CALOIGNAC for brandy not from Cognac was denied registration based on a finding of geographic deceptiveness, as it was held consumers would be misled into believing the brandy identified was a certified brandy from the Cognac region of France.

If a mark is found to be deceptive as to origin, it may also be enjoined from being used pursuant to false advertising and unfair competition laws. The marks HOUSE OF STUART BLENDED SCOTCH WHISKEY and LOCH-A-MOOR were enjoined for use on a whiskey-based product produced with non-Scotch whiskey outside of Scotland, due to their deceptive nature.

The deceptive use of geographical terms on wine labels came into sharp focus recently with the final resolution of the *Bronco v. Jolly* case wherein Bronco Wine Company challenged the constitutionality of a California law requiring that any wine label featuring the term "Napa" (other than as part of the required city name for the production location for the wine), or any sub-appellations located within Napa County, be derived 75% or more from grapes grown in Napa County, California. The California Supreme Court held this consumer protection law to be constitutionally valid, and this decision was upheld by the U.S. Supreme Court. Shortly thereafter, a second California law was passed with

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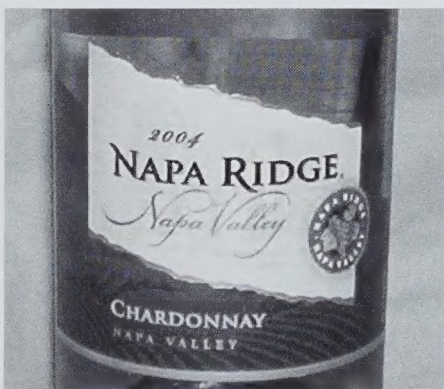
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similar requirements for the use of "Sonoma" on wine labels.

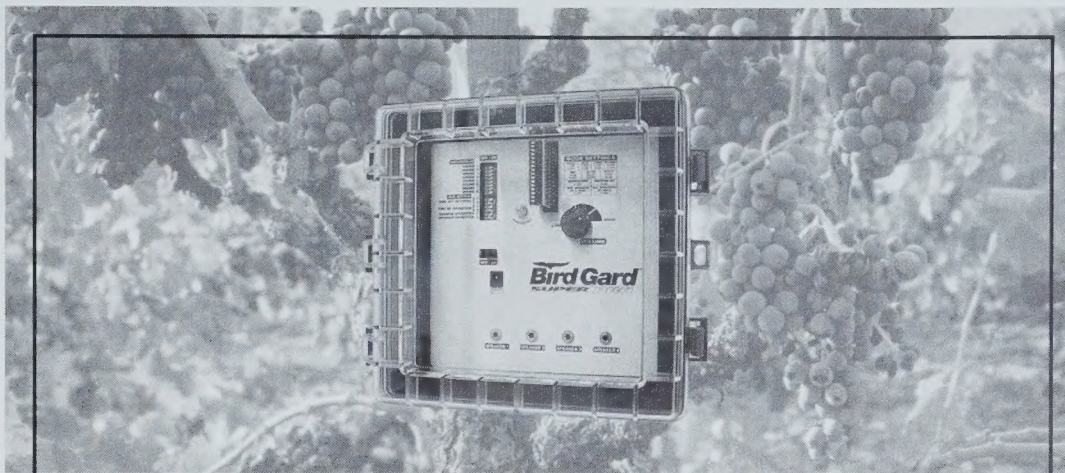
One may ask, however, why such a law was necessary when federal law already prohibits the deceptive use of geographical terms and federal labeling law requires that wine labeled with a recognized appellation or American Viticultural Area (AVA) be derived 75% or more from the appellation, or 85% or more from the AVA identified.

Turning first to the federal labeling law, the California statute was necessary to close a loophole in the federal law. In enacting the federal law recognizing appellations and AVAs, a grandfather provision was simultaneously enacted. The grandfather provision applied if a brand name encompassed a subsequently recognized appellation or AVA and was the subject of a Certificate of Label Approval (COLA) issued prior to 1986. In that case, the brand name could continue to be used on wine not produced from grapes originating in the particular appellation or AVA identified in the brand name, so long as the true origin of the grapes was also identified on the label.

For several years, this grandfather provision was a non-issue. Most wineries with geographical brand names continued to use those brand names only for wines derived from grapes from the place identified in the brand name, or only for small production of wine made from grapes originating outside of the place identified in the grandfathered brand name.



However, this situation changed dramatically when certain grandfathered COLAs were sold and the geographical brand names in those COLAs were then used for large-vol-



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ume production of wine made from grapes grown in regions other than those identified in the grandfathered geographical brand name.

In the case of "Napa" geographical brand names, evidence indicated that the use of these brand names on wine not from Napa County was deceptive

to consumers. For instance, the California Supreme Court found that even though NAPA RIDGE wine made from grapes grown outside of Napa County carried the true geographic origin of the wine, such as "California" or "Lodi," this was not sufficient to prevent consumer deception.



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In light of this shortcoming in the labeling law, such deception could have been addressed on a case-by-case basis pursuant to misleading advertising and unfair business practices laws. However, under the California law, the California Department of Alcohol Beverage Control was charged with the obligation to prevent the deceptive use of "Napa" on wine, much like the TTB under the federal labeling laws. Thus, the benefit of the California Napa and Sonoma labeling laws relative to the false advertising laws is that it eliminates the need for costly, private case-by-case lawsuits against deceptive uses of "Napa." The duty to police proper use and enforce the law falls to the government.

With the Supreme Court affirmation of the constitutionality of California labeling laws, every wine carrying the term Napa or Sonoma produced or sold in California must comply with federal labeling laws for these counties, regardless of the grandfather provision contained in the federal labeling laws. Thus, brands such as Sonoma Creek,



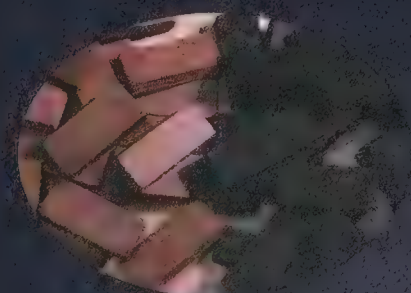
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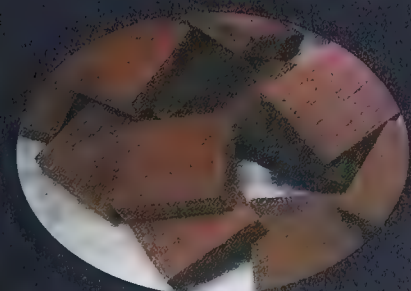


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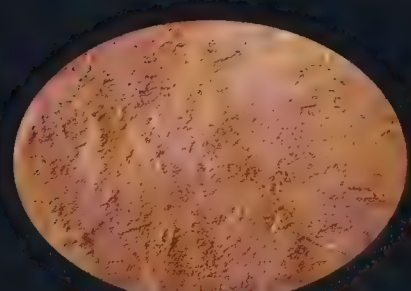
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which previously produced wines from non-Sonoma grapes under the SONOMA CREEK mark, can no longer produce or sell such wine under the mark.

California laws specifically protecting Napa and Sonoma, however, are fairly unique. They are also limited to the production, advertising, and sale of wine occurring within the borders of the state of California.

The federal false advertising and unfair competition laws apply more broadly to the deceptive use of any designation of origin and cover acts occurring anywhere within the United States, and thus are broader in the protections offered to designations of origin. Nonetheless, the federal false advertising and unfair competition laws generally must be enforced privately, and without enforcement, these laws have no real practical effect.

From the perspective of a brand owner desiring to use a geographical



term in a brand name, the risk in doing so is great. If the term is geographically descriptive, the brand owner is faced with the protection problem faced by Santa Barbara Winery. If the term is deceptive, the brand owner is faced with the larger problem of losing rights in the mark and being enjoined from using the mark going forward. In either scenario, the disincentive to use of a geographical term in a brand name is obvious.

Pitfalls in recognition of new AVAs

Undoubtedly there is a marketing advantage to producing wine from a recognized appellation or AVA. There

is also the benefit of having TTB undertake the responsibility of supervising proper, non-deceptive use of the appellation or AVA where the grandfather rule does not apply. As a result, many wineries are eager to have their regions recognized as appellations, specifically as AVAs. However, with such recognition comes potential risk, especially where the AVA is also used in brand names.

For instance, CHALONE VINEYARD is a well-known wine brand, but "Chalone" is also a recognized AVA. While Chalone Vineyard owns most of the vineyards contained within the Chalone AVA, there are other vineyard owners within the AVA, and wines are being produced and sold under the Chalone AVA by producers other than Chalone Vineyard. Wines labeled with the Chalone AVA include: A DONKEY AND GOAT, MICHAUD, and TESTAROSSA.

In properly using the recognized AVA of Chalone in the manner of a designation of origin, these brands are acting in compliance with the labeling laws. Thus, even in the event there was some consumer confusion with Chalone Vineyard based on the use of this AVA by these brands, which is certainly possible, Chalone Vineyard would have great difficulty in taking any action to prevent the fair use of the AVA by these brands.

If a new AVA is recognized and encompasses a producer's brand name, another problem may arise if the brand is not subject to the grandfather provision of the federal labeling laws. Once an AVA is established, any non-grandfathered brands containing the AVA that may have legally used the brand name on wine from outside the AVA must then only use that brand name on wine originating from the new AVA.

Prior to the recognition of "Rockpile" as an AVA, under the federal labeling laws various brands containing the term "Rockpile" were free to include wine from larger appellations under their respective labels. However, upon recognition of Rockpile as an AVA, those brands were required to only use the respective "Rockpile" brand names on wine derived 85% or

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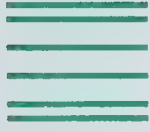
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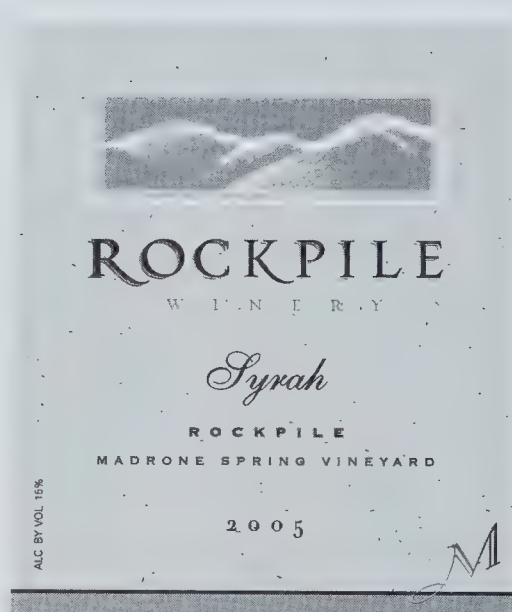
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more from grapes originating in the Rockpile AVA. Thus, the recognition of an AVA can also have a limiting consequence on owners of brands containing the AVA.

In some circumstances, this has been avoided. For instance, in recognizing Chehalem Mountain as an AVA, the TTB held that the term of "viticultural significance" was "Chehalem Mountain," not "Chehalem" standing alone. The effect of this is that TTB will only deny or revoke a COLA where "Chehalem Mountain" is being used on wine not derived 85% from the Chehalem Mountain AVA, but not where the term "Chehalem" without "Mountain" is being used on wine not derived 85% from the Chehalem Mountain AVA.

As a result, TTB will not interfere with Chehalem Wines' continued use of the CHEHALEM mark on wine from outside of the Chehalem Mountain AVA. In essence, even



though CHEHALEM is not a grandfathered brand, TTB's recognition of "Chehalem Mountain" as the term of viticultural significance allows the mark to function as if it were a grandfathered brand.

From an equitable perspective, this approach may seem fair as Chehalem Wines (Newberg, OR) used its mark for 15 years before the AVA was officially recognized. However, to the extent that the region had any general recognition as an area for the production of wine before Chehalem Wines began using its mark, the result may appear unjust, since "Chehalem" is obviously the distinctive term in both the trademark and AVA, and the term which will be remembered by consumers. Thus, the recognition of the "Chehalem Mountain" AVA would appear to have little value since under the TTB rules anyone can use the term "Chehalem" without "Mountain" on wine produced from grapes grown anywhere.

While Chehalem Wines might object to the use of "Chehalem" as part of a brand by third parties, it might have little grounds to do so where the term is used for wine actually from the Chehalem Mountain AVA, such as a brand called "Chehalem Landing" for wine from the Chehalem Mountain AVA. Furthermore, the TTB would not weigh in one way or the other against any use of the term "Chehalem" other than in the composite "Chehalem Mountain."

Since TTB has opted not to prevent use of "Chehalem" by itself or in combination with terms other than "mountain" on wine not from the Chehalem Mountain AVA, growers and wineries in the AVA would be forced to seek recourse pursuant to false advertising and unfair competition laws if they believed use of "Chehalem" on wine from outside the Chehalem Mountain AVA were deceptive.

Geographical designations that have become generic

Some geographical terms have become generic identifiers for certain styles of wine — for example, champagne and port. Even though "Champagne" identifies the Champagne region of France and "Port" identifies the Oporto region of Portugal, to American consumers, these terms mean "sparkling wine"

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and "sweet fortified wine." Therefore, American consumers encountering these terms on wine products produced in the U.S. do not view them as identifications of origin, but rather as generic identifiers of style. As a result, use of these geographical terms in a generic sense is not considered to be deceptive.

There is a caveat, however, concerning the use of generic terms with European geographical significance. In 2006, the U.S. entered the bilateral Wine Accords with the European Union, whereby the U.S. agreed not to allow non-E.U. wines to use certain generic terms with European geographical significance, such as Champagne and Port.

(The full list of covered terms is as follows: Burgundy, Chablis, Champagne, Chianti, Claret, Haute Sauterne, Hock, Madeira, Malaga, Marsala, Moselle, Port, Retsina, Rhine, Sauterne, Sherry, and Tokay). This treaty was enacted in the U.S. in

December 2006 with an effective date of March 2006.

Accordingly, the aforementioned generic terms may no longer be used on wine by American producers *unless* a producer owns a COLA issued prior to March 10, 2006 for use of the generic term in association with a particular brand name and fanciful name. If a producer owns such a COLA, it is grandfathered and may continue to use the generic term in association with the brand name and fanciful name identified in the pre-March 10, 2006 COLA, such as Gallo Hearty Burgundy. Absent such exception, however, American producers are banned from the continued use of these previously generic terms.

Conclusion

The law concerning the use of geographical terms on wine labels is complex and convoluted. The best course of action for a producer is to adopt a brand name with no geographical significance,

and to only use geographical terms to fairly describe the true origin of the wine. To do otherwise, one risks losing value in any brand investment as well as the possibility of having one's sale of wine enjoined based on geographical issues.

The best use of geographical terms is to identify the origin of one's wine, not its producer. When the "who" becomes the "where," confusion ensues and risk to the producer is greatly increased. ■

[J. Scott Gerien has represented wineries and vineyards on trademark matters for more than 10 years. He is head of the intellectual property department of Dickenson, Peatman & Fogarty, (Napa, CA), a member of DP&F's wine industry practice group, and Chairman of the International Trademark Association's North American Subcommittee on Geographical Indications. He may be reached at 707/252-7122 or sgerien@dpf-law.com.]

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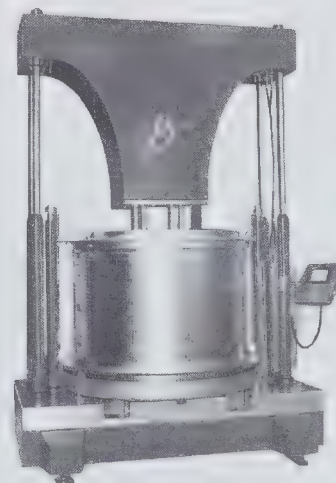
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Barrel rooms are located along a working corridor that allows tasting room visitors to see barrels through large oak and glass doors set into arched openings. Natural light enters high clerestory windows above.



Merging function and sustainability in a bright, daylit Oregon winery

BY Joe Chauncey
Boxwood I Architecture & Design
Seattle, WA

Pinot Noir is to Oregon as Mozart is to music — *defining!* Its reputation for being hard to grow and even harder to craft into great wine has winemakers building wineries that cradle this easily bruised grape in gentle gravity flow.

Tannin management is critical in Pinot Noir and can be managed in many ways, from a simple, highly efficient winery with only two levels and a good forklift operator, to an intensely vertical facility with as many as seven levels! August Cellars (Newberg, OR), strikes a balance with 16,000 square feet on three and a half levels over a 30-foot, steeply sloping site.

Large clerestory windows drop daylight down two levels to the tasting bar. Half of the windows are thermostatically controlled to open and allow heat to escape during the warm months drawing, by convection, cool air through operable windows at ground level.

Named after great grandfather August Schaad who settled and farmed the area beginning in 1903, August Cellars is located at the base of an old walnut grove planted by grandfather Clarence 50 years ago. Jim Schaad (winemaker), Tom Schaad (operations), parents Lewis and Barbara, and Aunt Grace decided to diversify the family walnut business and move into the wine industry.

Farmers at heart, with a respect for the land, the Schaads wanted a sustainable winery that addressed practical winemaking considerations while remaining ecologically sensitive and economically efficient. They invited Boxwood to help them achieve their vision with a detailed knowledge of winery operation, energy conservation, sustainability, and the winemaking process.

Crush

Along with gentle grape handling, the goal at the crush pad was to maxi-



Crush balcony: one bin dumper drops fruit onto the sorting table while the forklift brings next bin. Clear Lexan roof panels allow maximum daylight on the crush pad to improve safety and quality. Large translucent wall panels and roof monitor (right), brighten the interior of the winery, and reduce eyestrain when moving bins from crush pad to fermentation area.

COVER STORY

mize natural light, provide rain protection, and promote worker efficiency. Grapes arrive in 1/2-ton bins on the top level of the winery. The roof of the crush pad is clear Lexan panels that allow as much light as possible to reach the sorting process while providing rain protection from the often wet fall season.

A concrete and steel superstructure eight feet above the crush pad floor supports the destemmer and sorting conveyor. After each bin of grapes is weighed, a forklift raises it to one of two hydraulic bin dumpers. In alternating sequence, they slowly tip bins into hoppers that drop grapes gently



The upper fermentation level, with two rows of fermentation bins on each side of a wide working aisle. Natural light penetrates from all four sides, reducing glare and allowing winemakers to work throughout the daylight hours without need for artificial lighting.

onto a shaker-type sorting table. Bad clusters and MOG are removed by four sorters stationed on opposite sides of the table, assuring that only the highest quality clusters move through an Armbruster AWS 4-8 destemmer-crusher into fermentation tanks.

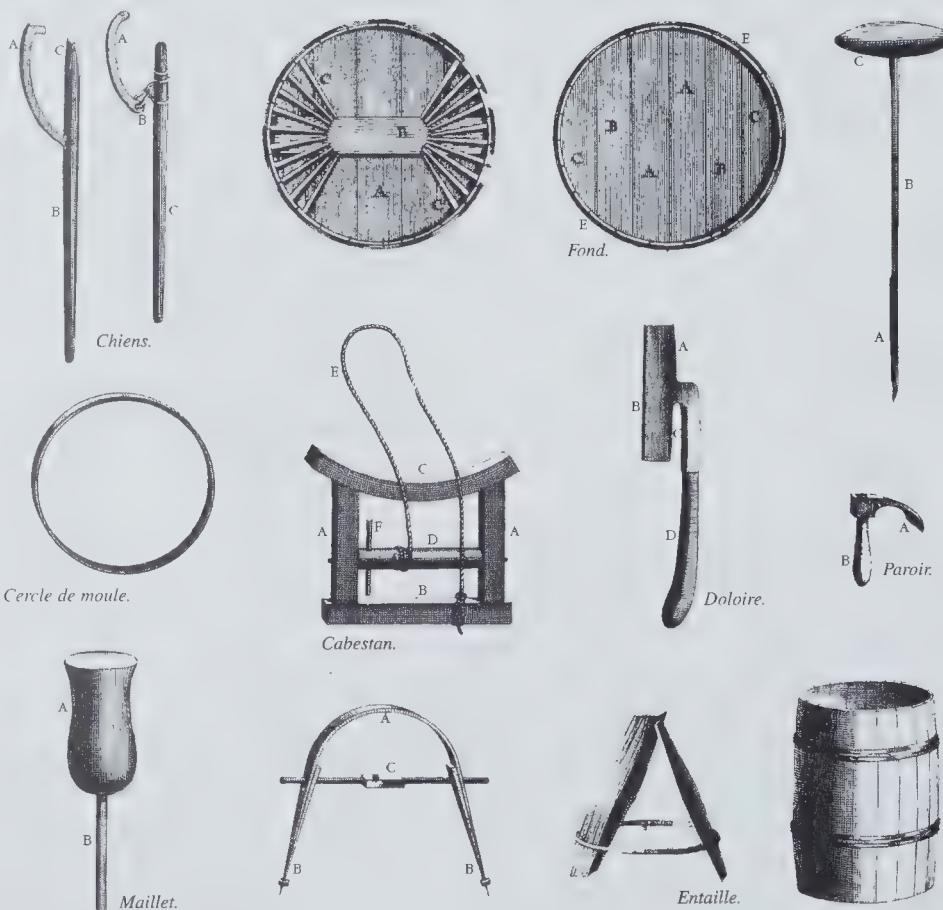
This system allows for the continuous flow of grapes into 1.5-ton capacity tanks without interruption because of the tandem bin dumpers and a diverter at the bottom of the destemmer-crusher that can switch the output hopper to either of two tank positions. When one fermentor is filled, the diverter is thrown to drop fruit into another fermentor, while the full tank is replaced by a forklift.

Stems are directed to a bin dumper at the far end of the winery, and stems are dropped into a dumpster. All red grapes are processed this way at a volume of up to four tons per hour.

White grapes go direct-to-press. From the sorting table, grapes drop into a Wilmes 2500L membrane press that can be slid into position under the output hopper.

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Large holding tanks are bathed in natural light provided by translucent clerestory windows behind photographer. A large amount of North light is also allowed to drop down into this level from the upper fermentation level above the holding tanks.

All of these procedures require testing and paperwork, so office and lab proximities are critical to achieving time efficiency. The office and lab are conveniently located on the crush and fermentation level.

Fermentation

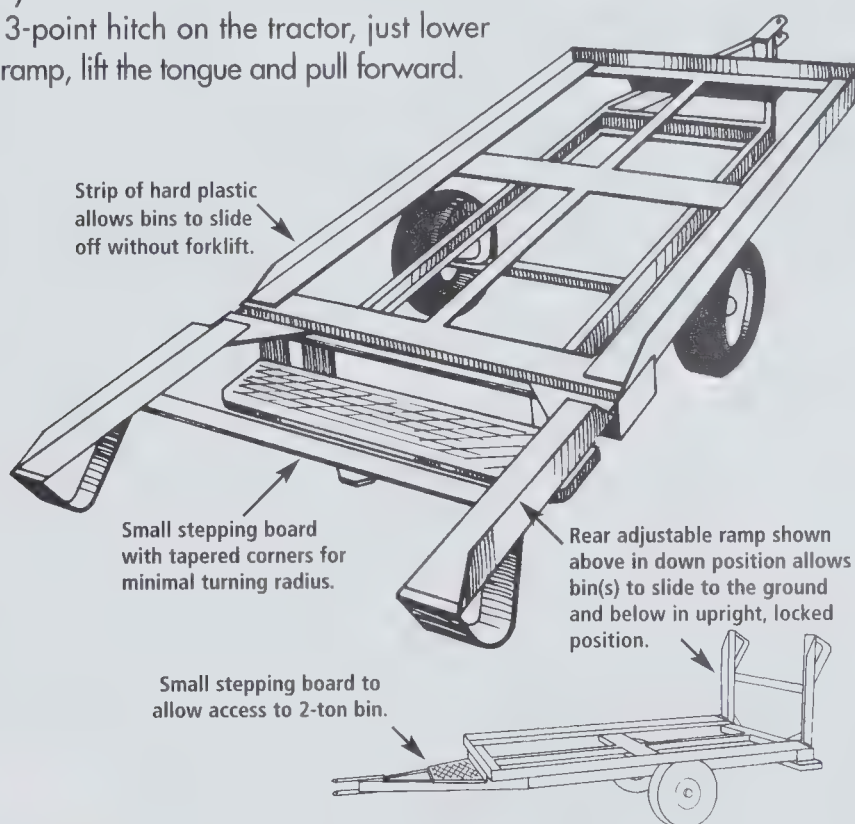
From the crush pad, 1.5-ton fermentors are moved by forklift into the fermentation room. The goal was to create a space that could operate during daylight hours without the need for artificial lighting. From a safety standpoint, working light needs to be as constant and free from contrast as possible so that the fork-

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lift operator's eyes do not have to adjust when moving between spaces.

Placing a large bank of windows on the north facade would have provided a



Elevated crush balcony supports tandem bin dumpers in the rear, sorting table in the middle and destemmer/crusher in the front. Processed fruit drops into an upside down "Y" chute with a diverter that can direct must to an empty tank, while the full tank is removed and replaced. Press (lower right) is designed to swing around under the chute for white grapes. Roof is clear Lexan to maximize natural light in the working area, and large translucent wall panels on the right drop light into the office area.

great deal of light; however, daylight along one wall creates glare. To solve the problem, a large north-facing roof monitor was designed that scoops in daylight high above the floor to supplement the north-facing window bank. These elements were balanced with a south-facing translucent clerestory that runs the entire length of the fermentation room. In combination with large overhead doors, an abundant amount of natural light from all directions brightens each wall and reduces glare.

The roof monitor has operable louvers that assist in temperature control by exhausting hot air accumulated during the day and pulling (through convection) cool night air into the winery. This process (called purging or night-time cooling) helps reduce energy costs without mechanical input.

The tanks are set up in groups of four along both sides of the fermentation level. Those outfitted with jackets can be plugged into quick-connect glycol lines evenly spaced along both sides of the fermentation level to manage fermentation temperature. All tanks are punched down by hand using a portable catwalk system that straddles individual tanks.

Upon completion of fermentation, red wine is pressed off and drained to stainless steel holding tanks on the middle level. Skins are taken to the walnut grove above the winery for composting.

Wine ageing

From the middle-level holding tanks, red wines are drained down into barrels for ageing on the lower level. White wines that are not aged in oak remain on the middle level. This level was designed to be open to the upper fermentation level, allowing natural light from above to spill over the balcony. Because this light was coming from only one side and aimed at the backs of the tanks, it was balanced with another linear south-facing translucent clerestory window that bathes the tank-fronts in natural light.

The chai, located on the lower level, is cut into the weathered basalt slope to take advantage of the earth's constant subterranean temperature. Nested in



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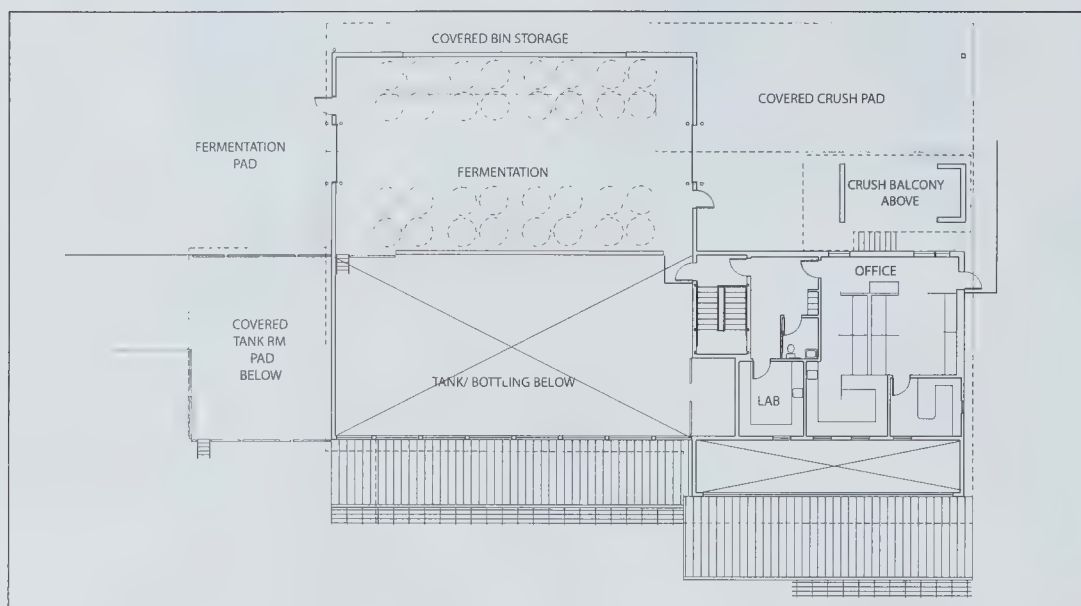


Figure 1: Upper-level fermentation room can be accessed from both ends via large overhead and personnel doors. It is physically connected to the tank room below.

parallel rooms directly below the stainless steel tanks and bottling line above, each chai has a large pair of hand-rubbed oak and glass doors set into

arched openings. The doors open onto a long trussed corridor that allows new barrels to be forklifted in from a loading dock on the west end of the winery.

This daylit working corridor was designed to serve as a buffer between the dramatic swings in temperature outside and the nearly constant temperature and humidity required in the chai. The subterranean chai have winter humidity levels between 75% and 85% and temperatures between 56°F to 58°F. Summer humidity levels are slightly lower and temperatures slightly higher, both changing very gradually between seasons. A linear trellis sunscreen keeps direct sunlight from falling on the chai doors.

Bottling

The bottling line and case goods storage are located on the middle level. Stainless steel tanks used for ageing white wines and holding red wines are also used to blend and finish wine for bottling. With direct outside access, and access over a loading balcony to the truck dock below, this

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middle level functions smoothly and efficiently. A large overhead door leads directly outside to the loading area.

The best functioning wineries have access around their perimeters to each area and each level. August Cellars was designed with access on all four sides.

Visitors

Visitors arrive at a parking area fingered into the second growth forest just below the lower level of the winery and can choose between stairs or a meandering path that winds around a small pond lined with native grasses and basalt to reach the tasting room. The pond serves both an aesthetic function and a pragmatic one — it provides storm water retention from roof drains.

A two-level water fall drives away any noise from the highway below,

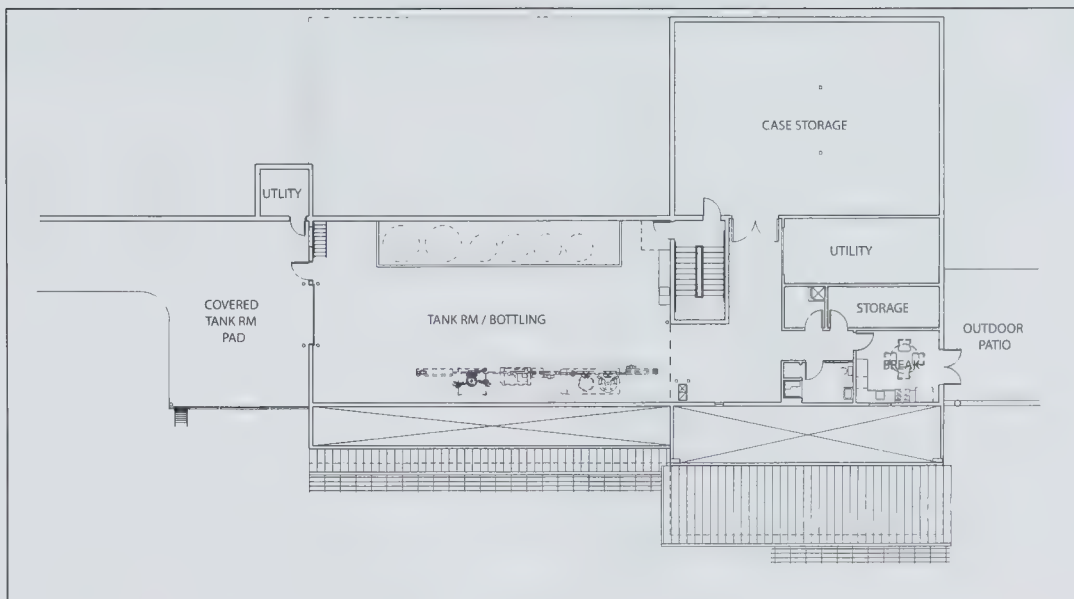


Figure II: Middle-level tank and bottling room is connected directly outside via large overhead door to an access drive and loading area. Completed case goods from bottling can be moved directly outside for shipping, or into a storage room just beyond the tank room.

and inlaid brick patios and benches welcome visitors. A hop-covered trellis offers shade from the hot sum-

mer sun. Picnickers can enjoy tables set into the second-growth fir forest on the east side of the winery.

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The tasting room is located on the east end of the chai working corridor. Here, visitors can taste wine and enjoy views into the chai. Set under large operable clerestory windows that dump daylight down through three-story-tall trusses, the tasting room is a bright, welcoming space.

The upper level clerestory windows align with office and lab interior windows on the upper level to allow views to the valley beyond. Thermostatically-controlled electric operators on the clerestory windows exhaust warm air as it rises, creating a chimney effect to bring in cool air from ground level.

Custom Crush wineries

In addition to operating their own 2,500 case winery, the Schaad family has opened its doors to seven boutique wineries:

- Laura Volkman Cellars — owned by Laura Volkman, who has a three-acre vineyard and produces under 300 cases of Pinot Noir.

- Anam Cara Cellars — owned by Nick and Sheila Nicholas, who own a vineyard and produce under 1,000 cases of Pinot Noir.

- Barking Frog — Owner Ron Helbign purchases grapes and loves big red wines, such as Yakima Valley fruit. Production is 300 cases with a goal of 1,000 cases.

- Artisanal Wine Cellars — Owner Tom Feller purchases grapes and produces Pinot Noir and Gamay Noir, and crushed Viognier in 2006. Initial production is less than 500 cases with a goal of 1,000 cases.

- Et Fille — Howard Mozeico and his daughter Jessica purchase and produce Pinot Noir. Production is less than 500 cases with an ultimate target of about 1,500 cases.

- WildAire Cellars — Matt and Jean Driscoll purchase fruit and produce Pinot Noir. Production is less than 300 cases.

- Toluca Lane — Jeffery and Lane Crowther own a vineyard and pur-

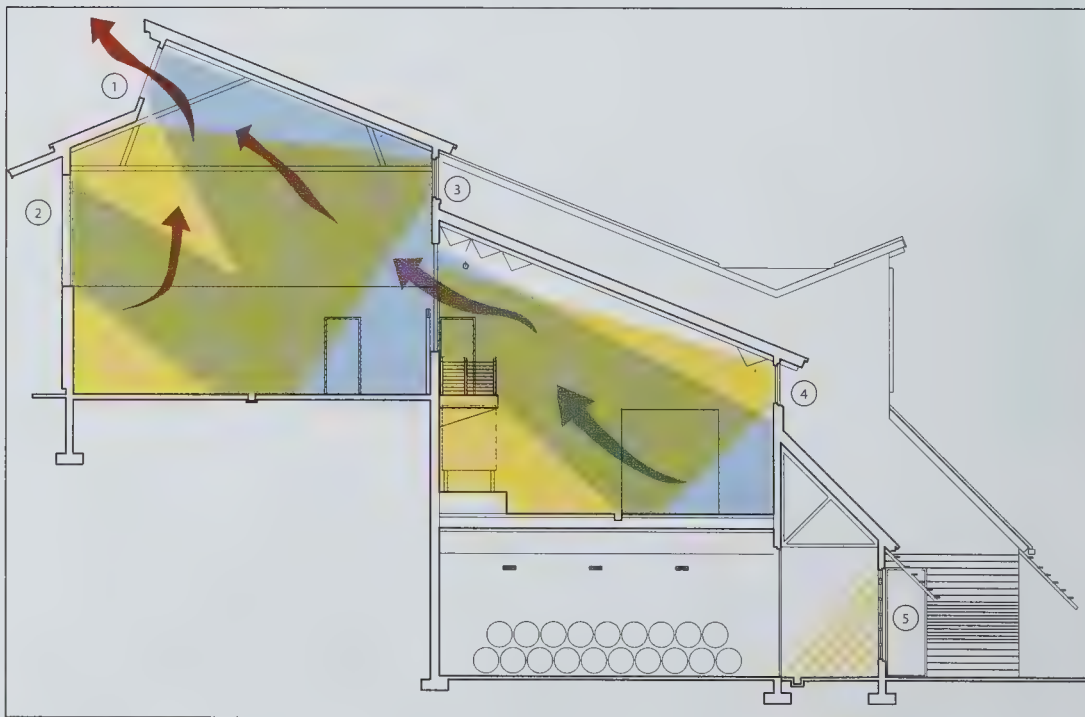


Figure III: Cool, north light enters the building through high clerestory windows (1), and transparent glazing (2) spilling down through the fermentation level to the blending level. To balance this light, warmer south light enters the space through translucent clerestory windows (3) and (4) casting a diffuse glow from the opposite direction onto tanks and working space. At the lower level, south sunlight is screened back with a sloped trellis outside the windows above eye level (5). Natural ventilation (illustrated with arrows) is promoted through convection. Warm air rises and exits through upper clerestory louvers, drawing cool air at the mid-level through louvers located near floor level.

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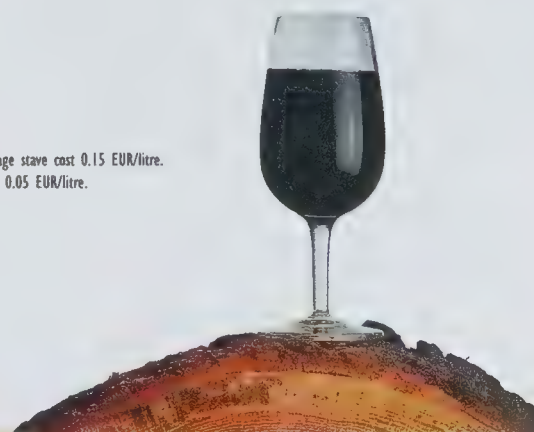
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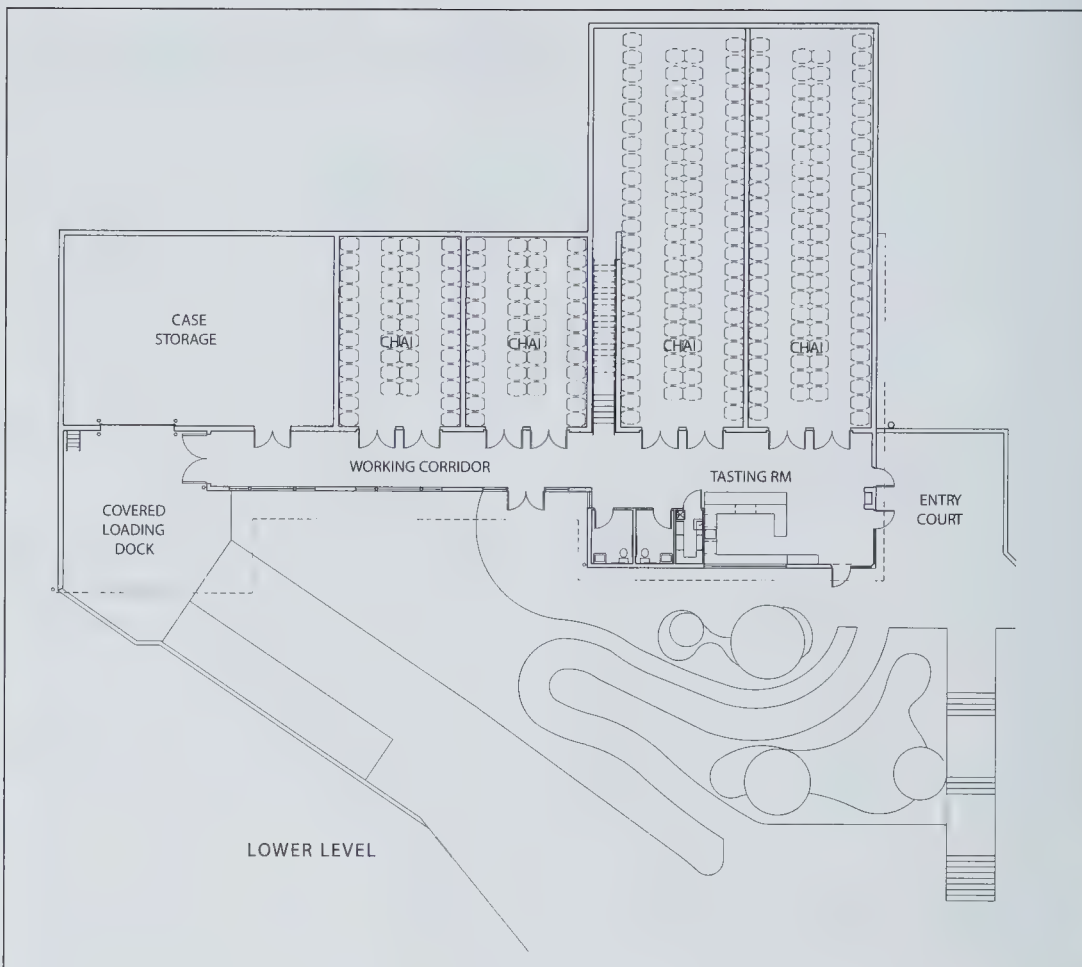


Figure IV: Lower level: One large and two smaller chai, as well as a storage room that can be sub-divided if another chai is needed, are set into the basalt hillside to take advantage of natural cooling. Tasting room is located on a working corridor with views into each chai.

chase fruit to produce Pinot Noir. Production is less than 500 cases.

The winery received 202 tons in 2006. August Cellars fermented 58.5 tons (31 tons of Riesling and 27.5 of Pinot Noir). August Cellars white wine production will increase by 10 to 12 tons while red wine volume remains stable. The busiest crush day handled 28 tons of red grapes.

More sustainable features

Construction materials were selected to work in combination with the sustainable operations designed into the winery. Cool metal roofing and siding from AEP Span, for example, utilizes paint technology that reduces the absorption of long-wave radiation, even in the darkest colors creating a reflectivity that reduces heat absorption and energy consumption.

Finger-jointed wood trusses made from small pieces of lumber have been

ganged together to create the illusion of large wood girder trusses. Wheat and sunflower board cabinetry, recycled concrete wall panels, eco carpet, linoleum, green wood products, and low VOC finishes all expand the sustainable design ideas of the architecture.

One sustainable benefit of this custom crush facility is that it is one winery instead of eight. This fact alone reduces the number of sites developed and the amount of construction materials used, while increasing energy conservation and reducing fuel consumption. Supply orders can be combined and the number of deliveries reduced. In 2006, 12,000 visitors tasted wine from multiple wineries in one stop rather than driving to five or eight individual wineries, reducing car trips.

The winery was built on what was, for 100 years, thought to be an unusable piece of family land, too steep for walnut trees or farming of any

kind. Thoughtful site planning, experience in winery function and design, and a collaborative client made this winery possible. The site is very steep, but not too steep for a cost-effective, efficient, multi-level Pinot Noir winery. ■

Boxwood I Architecture & Design is a Seattle, WA firm specializing in holistic

planning, architecture, interior and graphic design solutions. Founded by Joe Chauncey in 1989, the firm has completed several wineries in Washington and Oregon and currently has six wineries in various stages of design and construction in Washington and Oregon. Design team members on August Cellars were Cherry Lietz Snelling and Jeremy Reding and Andy Herrick. All Boxwood staff members have winery design experi-

ence and are LEED (Leadership in Energy and Environmental Design) registered professionals with the U.S. Green Building Council.

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IMPACT OF ETHANOL STRESS

Developing indicators of wine yeast performance

BY Simon A. Schmidt, Tina Tran,
Paul J. Chambers, Markus J. Herderich,
Isak S. Pretorius
The Australian Wine Research Institute,
Adelaide, South Australia

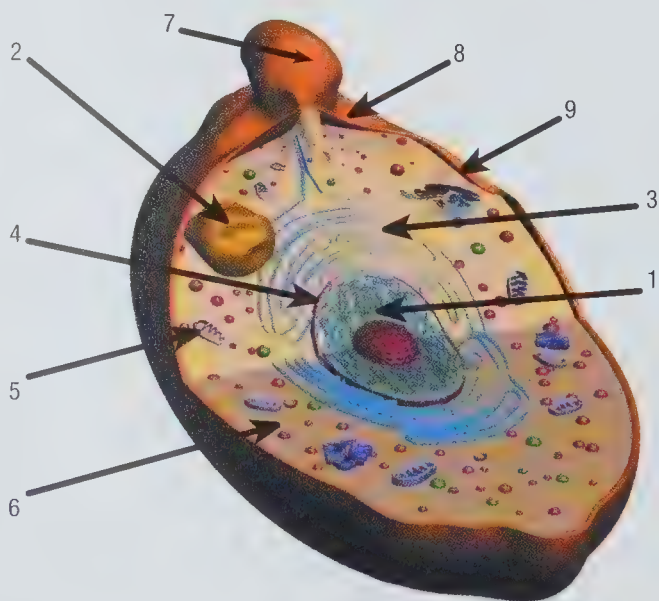
Wine yeasts have been with us for thousands of years and, over this time, have been selected, inadvertently and systematically, for their robustness and the quality of wine that they produce.

This has led to the generation of large collections of wine yeasts that can be accessed by winemakers to deliver reliability of performance and diversity of wines, but there is room for improvement in the yeasts that are available.

The problem of suboptimal (stuck and sluggish) fermentations is a case in point. While some yeasts are quite reliable performers others can be difficult to get started, are sluggish in performance, or are prone to becoming stuck before fermentation is complete, and these problems are very costly to the wine industry.

One option to minimize the risk of generating such problems is for winemakers to simply choose only the most reliable strains of yeast available to them, but this would limit the diversity of options available for delivery of different flavor profiles. Thus it would benefit the industry if we could find a means of improving the robustness of wine yeasts, particularly those that deliver desirable flavor profiles but currently have a

Figure 1A. Internal organization and compartments of a yeast cell.



KEY Figure 1A

- | | |
|-------------------------|-------------------------|
| 1 Nucleus | 5 Mitochondria |
| 2 Vacuole | 6 Fermentation |
| 3 Endoplasmic Reticulum | 7 Budding daughter cell |
| 4 Nuclear Membrane | 8 Cell Division |
| | 9 Cell membrane |

Figure 1B. The phospholipid bilayer of a cell membrane.

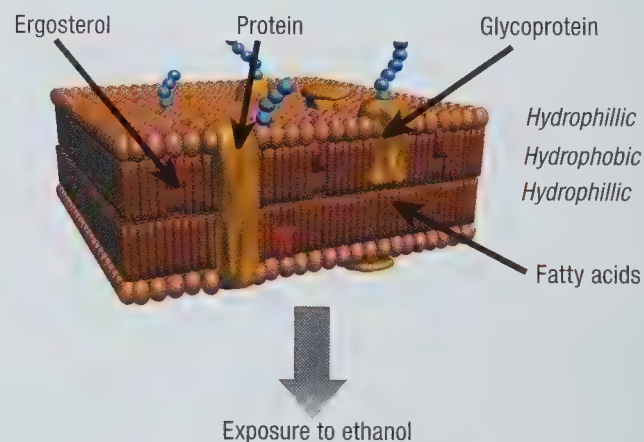


Figure 1C. Interdigitation of a phospholipid bilayer in response to ethanol-stress.

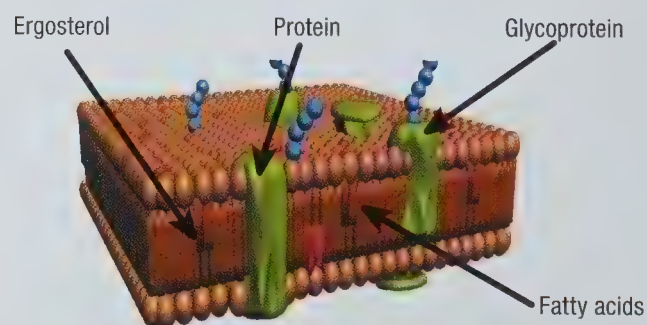


Figure 1: (A) Representation of a yeast cell highlighting key areas of the cell that are affected by ethanol. (B) Diagrammatic representation of a magnified cell membrane illustrating the bilayer organization of phospholipids and the integration of proteins, some of which act as gateways for transport of nutrients. Ethanol is soluble in cell membranes, and has dramatic impacts on the integrity of its structure. In fact, the membrane is thought to be one of the principal 'targets' for ethanol. (C) This figure illustrates the impact of ethanol on biological membranes. Fatty acids from opposite sides of the phospholipid bilayer become interdigitated, and proteins are thought to be affected (illustrated as a color change, yellow to green, between Figures 1A and 1B); however, the precise affect of ethanol on membrane proteins is not well understood. Illustrations by Dung Quoc Tran.

propensity to be suboptimal performers. This article describes the first stages of work at the Australian Wine Research Institute (AWRI) that is attempting to achieve this end.

While considerable research has gone into studying suboptimal fermentations, and progress has been made in identifying features of grape must that are likely to compromise yeast performance,^{2,6,7,9} other than A. Zuzuarregui and M. L. del Olmo,³² there are few reports in the literature of research directed to assessing the relative robustness of different wine yeasts with the aim of improving their performance and/or reliability.

Most of the information we have on the relative efficiency and reliability of different wine yeasts is from anecdotal reports; most winemakers know which of the strains available to them are likely to perform well and which are less reliable. The AWRI is using a more systematic approach to assess the relative robustness of many commonly used wine yeasts with the aim of improving those that are

most susceptible to suboptimal performance but are regarded as delivering good sensory properties to wines.

Developing a laboratory-based approach to assessing resilience of wine yeasts is, however, not a straightforward exercise; particularly when one is interested in their robustness in a commercial winemaking setting.

First, one has to identify "indicators" of robustness, and for this we have decided to use ethanol tolerance. We have chosen this criterion because it is widely believed that, in the industry and yeast research, ethanol stress of yeast is a major cause of suboptimal fermentations.^{9,18,23,24}

But what makes ethanol toxic to cells, and how might it induce suboptimal fermentation performance in wine yeast?

Effects of ethanol on cells and how yeast responds to this stress

Many cellular functions and the structures that support them are compromised by high ethanol concentrations (Figure 1),

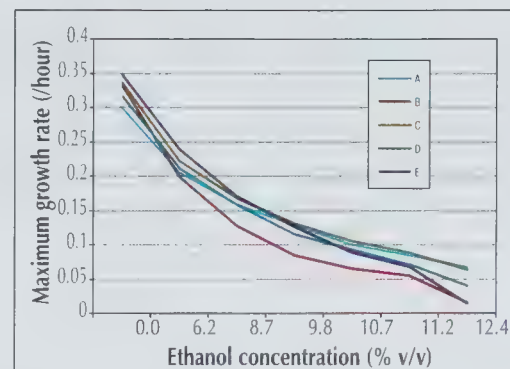


Figure 11: Effect of ethanol on population growth rate for five strains of wine yeast. The values indicated by colored lines represent the estimated mean maximum growth rates of different strains. Five strains were grown in the presence of increasing concentrations of ethanol in a modified Henschke and Jiranek-defined medium (Henschke and Jiranek 1993), reflecting the general composition of grape juice in pH, acid, vitamin and trace element profile. The growth of cultures was monitored by measurement of optical density (OD) at 600nm (OD600) every 20 minutes for 72 hours.

and this leads to, among other things, slowing of the cell cycle (there is a

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Table I: Wine strains used in this study.

Strain	Uses	Sensory characteristics	Fermentation performance*
A	Champagne base, secondary ferments, restarting stuck ferments	Neutral	Consistently excellent performer under demanding conditions. Is often used to rescue stuck fermentations
B	Blush whites, young reds	Esters and higher alcohols	Good starter, slow to finish
C	Whites	Passion-fruit, grapefruit and guava	Slow starter, intermediate finishing
D	Whites	Enhances tropical fruit and floral flavors	Good performer
E	Whites	Enhances varietal characters	Intermediate performer

* The comments in the column entitled 'Fermentation performance' are based on anecdotal reports from winemakers and yeast scientists, and on information from the companies that supply these yeasts.

reduced rate of cell division) and, as is clear from results presented in this article, a general inhibition of cell growth.^{10,27}

A principal target of ethanol in yeast cells is undoubtedly their membranes. Cellular membranes are amphipathic

(part hydrophobic, or water-repelling, and part hydrophilic, or water-attracting), complex and dynamic structures, comprised principally of a double layer of phospholipids, with embedded proteins and sterols (Figure 1). These lipid

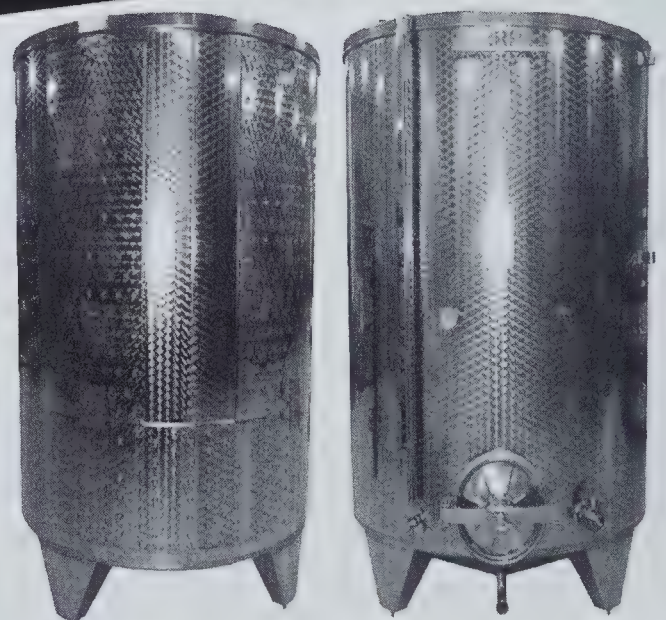
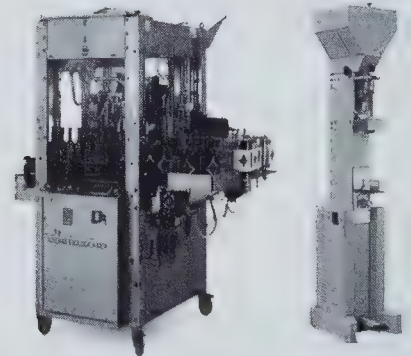
bilayers define the cell's outer boundary and delineate inner compartments from each other and from the milieu of the cytoplasm. Some of them, particularly the inner membrane of the mitochondrion, are the sites for energy production, and all cell membranes carry gateways made of proteins for transport of materials into and out of cells and cellular compartments.

Membrane integrity is therefore critical for many cellular functions, but this integrity is compromised by ethanol. Ethanol is soluble in the phospholipid bilayer and, when present, associates with fatty acids in the sandwiched hydrophobic region. This causes the phospholipids to become hyperpolarized, preventing neighboring fatty acids from "sticking" to each other as they normally would (by weak chemical interactions known as van der Waals forces), thereby making the membrane more fluid.^{4,6,15,16,19,21,29}

Some experimental work has also demonstrated that the fatty acids on

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opposite sides of the bilayer become interdigitated (Figures IB and IC), which impacts on the width and physical properties of the membrane.^{27,31} The full significance of this for membrane function is, however, unknown.

One of the effects of ethanol on membrane function is that the lipid bilayer has increased permeability to small molecules and ions, which therefore leak into or out of the cell, depending on the direction of the concentration gradients (for example, see G. M. Walker 1998b). This perturbs cell homeostasis, which impacts detrimentally on many cellular activities; metabolism, for example, is very sensitive to changes in ionic composition in the cell.

While cell membranes become more permeable to small molecules, however, the protein transporters (gateways) used to ferry large molecules, such as sugars, from one side to the other are incapacitated. Thus transport of large molecules is blocked. This means that the cell is effectively starved. In the context of wine fermentation, this means that grape sugars cannot get into the cell and the fermentation becomes stuck or sluggish.

But, as many winemakers know, robust wine yeasts still function at relatively high ethanol concentrations; they are not passive victims of the effects of the ethanol they produce. Indeed, compared to most organisms, including other yeasts, *S. cerevisiae* acclimatizes remarkably well to ethanol stress, and if we could understand the basis of this acclimatization, we might be better able to generate or identify novel yeasts with improved ethanol tolerance and resilience.

What is the basis of acclimatization to ethanol stress in wine yeast? In response to accumulating ethanol in their environment, yeasts presumably make many alterations to their biochemistry and physiology, but much of this field of research remains to be explored.

One of the best-studied aspects of the yeast cell response to ethanol stress is the induced changes that are observed in the composition of cell membranes. Many studies have shown that, in the presence of ethanol, yeast cell membranes have increased amounts of unsaturated fatty acids and sterols, the latter of which are known to reduce membrane fluidity, and therefore minimize the detrimental effects of ethanol on the cell.^{2,19,25,26}

K.J. Tierney *et al.*, (2005) found that ethanol-induced interdigitation of fatty acids in the membrane was also delayed in the presence of sterols such as ergosterol, but the significance of this to the acclimatization of yeasts to ethanol stress is not known.²⁷

It appears that changes in membrane lipid composition are important for tolerance to ethanol stress. However, in the context of wine fermentations, it is important to note that yeasts are unable to synthesize sterols in anaerobic conditions. Instead they have to obtain them from the growth

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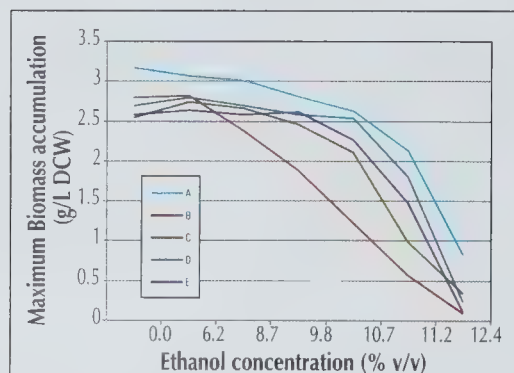


Figure III: Effect of ethanol concentration on biomass accumulation for five strains of wine yeast. Colored lines indicate the average maximum biomass (as dry cell weight, DCW) accumulated by replicate cultures of the indicated wine yeast strains after 72 hours, at the initial ethanol concentrations indicated on the X-axis. Biomass was determined from OD600 values, using calibration curves that define a linear relationship between optical density and biomass.

medium; this is one reason why the addition of lipid supplements to must

is beneficial to yeast growth and fermentation performance.

Stress-induced changes in gene expression and acclimatization to ethanol stress

Along with ethanol-induced changes to membrane composition in cells there are also changes in the level of expression of many genes. *S. cerevisiae* has over 5000 genes, and hundreds of these are up- or down-regulated in response to ethanol stress.^{1,11}

For example, many of the "heat-shock protein genes," have consistently been found to have increased expression levels in cells exposed to ethanol stress. These genes were first identified because they were found to be activated in response to the stress caused by shocking cells with a sudden increase in temperature, hence their names. They have since been shown to be up-regulated in response to a range of different stresses.

Perhaps it is not surprising that pre-exposure to heat shock increases toler-

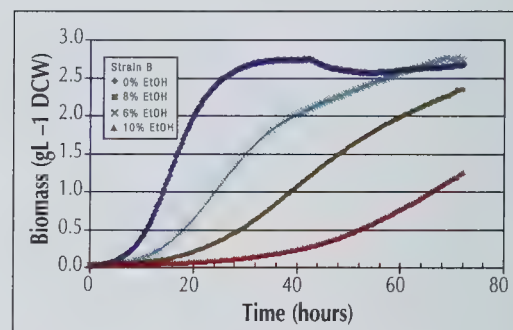
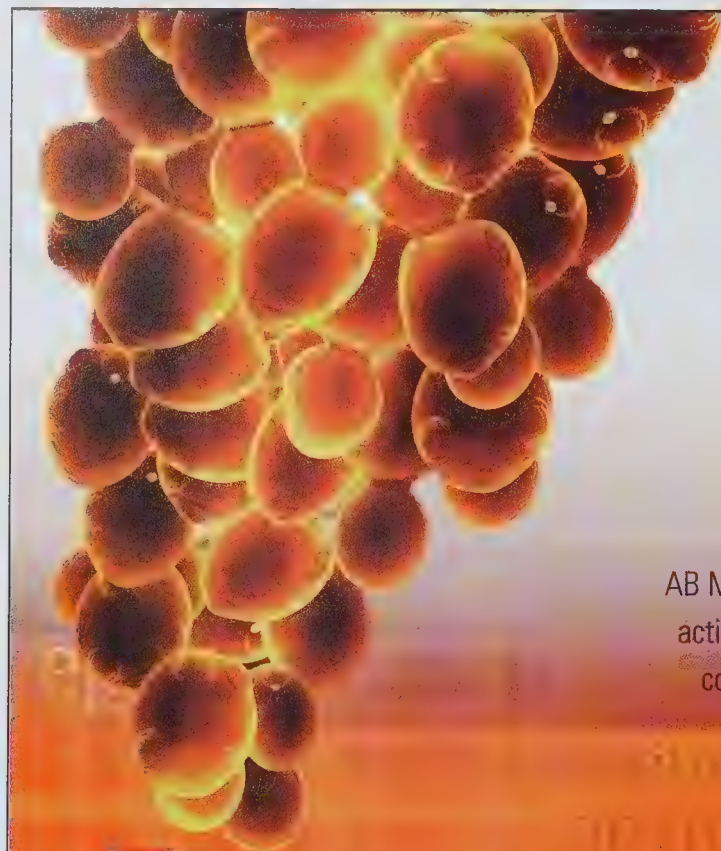


Figure IV: Time-course of biomass accumulation for strain B exposed to varying concentrations of ethanol. Conditions for this assay are as described in the legend to Figure II.

ance to ethanol in *S. cerevisiae*.³⁰ While it might be tempting to speculate from the above that heat-shock proteins must have roles in conferring ethanol tolerance in yeast, the evidence for this being the case remains, in most cases, circumstantial. In fact when many of these genes are individually deleted from the yeast genome, tolerance to ethanol stress is unaffected.



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The relationship between changes in gene expression and associated increases in ethanol tolerance is not a simple one. Unraveling the basis of ethanol tolerance in *S. cerevisiae* is clearly not going to be easy, but this does not mean that we cannot make progress in improving this trait in wine yeasts.

In fact, the approach that we are starting with requires no knowledge of the mechanisms underpinning stress-tolerance. Instead, we have identified strains covering a range of ethanol tolerances, and we are using a Darwinian selection strategy to "breed" increased stress tolerance into less resilient strains. Such variants will be of direct benefit to the wine industry and be useful tools that we can apply to our research on stress tolerance. What we learn from these variants will feed into future research on designing and tailoring yeasts for optimal performance.

Choice of wine yeast strains used and criterion for assessing robustness

The starting point for the work described in this article was to identify a cross section of commercially available wine yeasts that perform quite differently in wine fermentation; such as imparting different sensory attributes, and reportedly differing in their reliability or fermentation efficiency. The strains chosen and their attributes are listed in Table I.

The next stage of the project was to develop methods for assessing ethanol tolerance of these yeasts, to see if this criterion was a suitable indicator of "relative robustness" of the strains; in other words, does ethanol tolerance reflect the reported efficiency and reliability of the chosen strains? With an assay for "robustness" in place, it would then be possible to design a yeast selective breeding program to improve the robustness of poor performers that impart desirable sensory attributes to wine.



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Ethanol stress in yeast?

As is evident from the background information given previously in this article, some aspects of the impact of ethanol on a yeast cell are relatively well-understood. In contrast, the factors which render a yeast strain more or less ethanol-tolerant are not.

Ethanol-tolerance is defined in many ways, depending on methods used to assess it. These methods focus on facets of cellular physiology considered to be important for completion of the task for which that strain is used.

In regard to wine fermentation this can be reduced to four factors:

- 1) the effect of ethanol on the ability of a strain to grow;
- 2) the effect of ethanol on the ability of a cell to metabolize sugar;
- 3) maximum biomass accumulation in the presence of ethanol; and
- 4) the effect of ethanol on viability.

All of these measures of ethanol tolerance are affected by composition of the medium, temperature, and the starting

condition of the culture.⁸ Therefore, when assessing ethanol tolerance of yeasts, it is important to consider the conditions of the environment in which the yeast is expected to operate. In the case of wine yeasts, a suitable environment would mimic the pH, acid, sugar, nitrogen, and mineral content of a wine. Such a medium was defined by P. Henschke and V. Jiranek (1993), and is the environment in which we have tested our wine yeast strains.¹⁴

Effects of ethanol on growth

The above four different methods of assessing ethanol tolerance relate to wine fermentations in different ways. The first measure, growth by cellular reproduction, is important in a wine context because it is through growth in grape juice that the strain is capable of generating the biomass required to efficiently complete fermentation.

Fermenting yeasts have largely ceased growth well before the accumulation of growth-inhibiting levels

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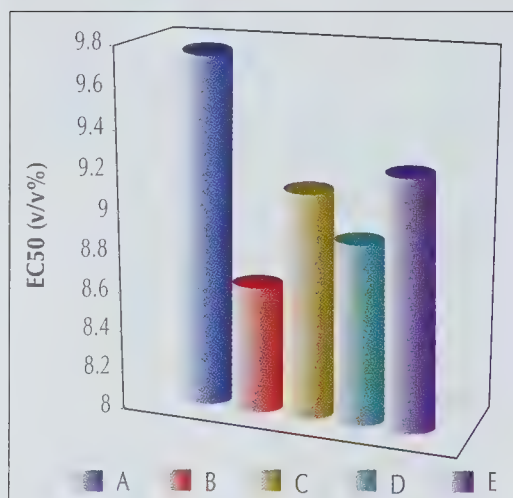


Figure V: Effect of ethanol on the ability of five strains of wine yeast to utilize sugar. The colored columns indicate the estimated ethanol concentration required to reduce by half the amount of sugar consumed in a 24-hour period. This is a modification of the method suggested by Gray (1941).

of ethanol, due to the limiting availability of other nutrients. Nonetheless, inhibition of cellular reproduction is a

useful indicator of overall stress. In fact, of all the measures, cellular reproduction is the most sensitive to increases in ethanol concentration.

As can be seen in Figure II, the maximum growth rates of wine yeasts are reduced by 30% in the presence of 6% (v/v) ethanol relative to their growth in the absence of ethanol. The overall performance of the strains is a testament to the general hardiness of yeasts currently used in the wine industry, since this level of ethanol is high enough to kill most single-celled organisms including most wild yeasts.

However, it is clear that strain-B is less tolerant of ethanol than the others; its growth rate is severely affected by increasing ethanol concentration. At 12% (v/v) ethanol, some strains are prevented from growing at all, and by 14% (v/v), even the most tolerant strains are unable to reproduce (data not shown).

At these concentrations, yeasts presumably experience severe disruptions to membrane structure and pro-

tein function. For example, at concentrations in excess of 8% (v/v), ethanol membrane structure is altered to become interdigitated and more fluid.²² As discussed previously, this assault on membrane integrity has enormous ramifications for the cell.

Effects of ethanol on biomass accumulation

Biomass refers to the total biological material (living and non-living) accumulated during fermentation and is typically measured as dry cell weight. Thus biomass is a measure of productive capacity which includes non-reproductive contributions to cellular growth.

Figure III shows the biomass accumulated by each of the five strains. At lower concentrations of ethanol, most strains were capable of accumulating levels of biomass not significantly different from that accumulated when no ethanol was added.

However, the time taken to accumulate equivalent levels of biomass is

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lengthened in the presence of ethanol (Figure IV). At higher concentrations, the ability of some strains to accumulate biomass is compromised. For example, cultures of strain-C inoculated into medium containing 10% (v/v) ethanol accumulate only 80% of the biomass of strain-A within the 72-

hour time course of the assay (Figure III).

The difference is even more pronounced for strain-B, which accumulates less than 50% of the biomass of strain-A, except in this case reductions in growth rate are also observed. This implies that some strains are capable of sustaining

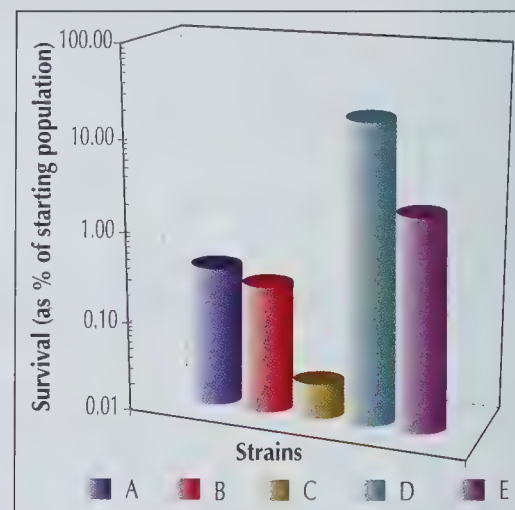


Figure VI: Survival of five strains of wine yeast after exposure to 14%(v/v) ethanol. Yeast strains were grown to mid-log phase, harvested and re-suspended at a concentration of $\sim 5 \times 10^7$ cells/ml in defined medium containing 14% (v/v) ethanol for one hour. Survival is expressed as the percentage of viable cells remaining after one hour, compared to the viable population at the time of inoculation.

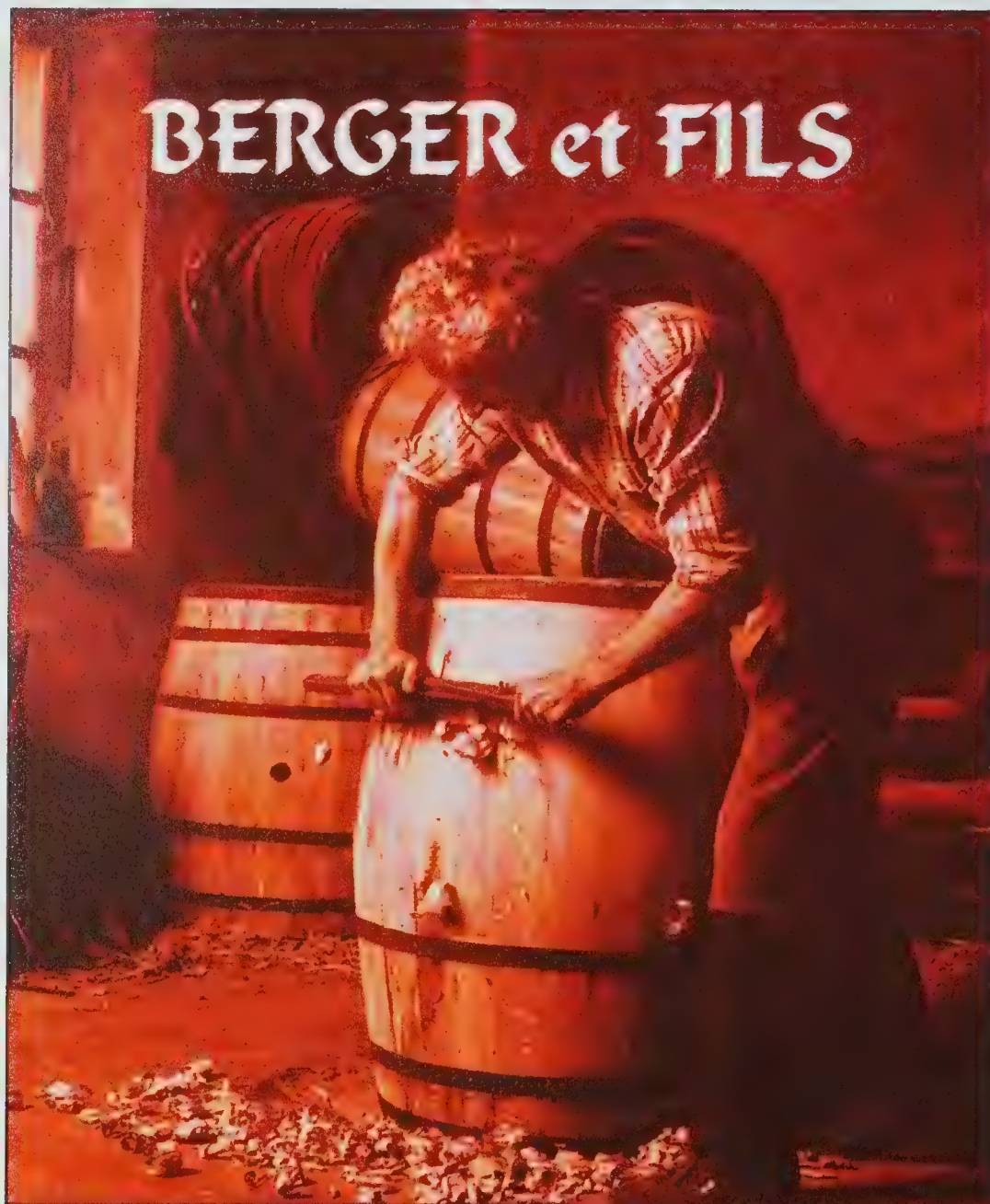
growth under stress for longer than others or that some strains take longer to recover from the shock of inoculation into medium containing such high concentrations of ethanol or both.

Impacts of ethanol on fermentative capacity

The effect of ethanol on a wine yeast's ability to utilize sugar is an issue which brings us to the heart of winemaking yeast performance. During fermentation, the majority of sugar conversion occurs in the presence of a continually increasing ethanol concentration. It is usually toward the later stages of fermentation, where ethanol concentration is high, that the prospect of a stuck ferment is not only more likely but the consequences of such an occurrence are more severe.

An assay for ethanol tolerance which mimics the conditions found during the final stages of fermentation, is important because it is likely to be the measure which most closely relates to yeast performance in industrial situations in which, as stated above, the yeast has largely stopped growing by the time significant amounts of alcohol begin to accumulate. Such an assay was developed by W.D. Gray,¹³ and a modification of this method was used to measure the fermentative capacity of the five strains used in this study.

Figure V shows the concentration of ethanol required to reduce glucose con-



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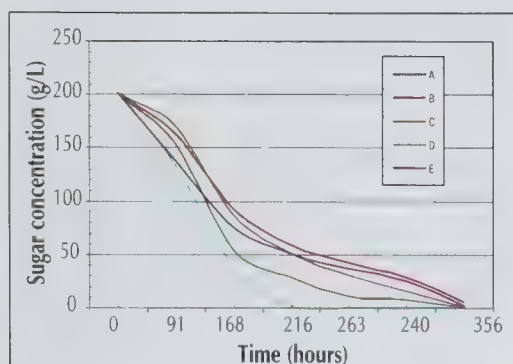


Figure VII: Rates of sugar usage for five wine yeasts in 100ml defined medium fermentations. Cultures were inoculated at 2×10^5 cells/ml into defined medium containing 100g/L of both glucose and fructose and 1.145g/L ammonium chloride (equivalent to 300mg/L nitrogen). The progression of sugar usage was measured by enzymatic assay.

sumption by half. This assay was performed in defined medium with low concentrations of glucose (10mg/L) to minimize the impact of endogenously produced ethanol on fermentation performance and to minimize the risk that the fermentation will run to a point where other nutrients become limiting.

As with the other measures of ethanol tolerance discussed previously, data in Figure V shows that yeast strains selected for their ability to perform well in winemaking conditions can be separated on the basis of their fermentative performance in the presence of ethanol. All strains tested were able to utilize 100% of the available sugar in the presence of up to 6% (v/v) ethanol within the designated 24-hour period (data not shown). However, at ethanol concentrations higher than this, there was a rapid decline in their sugar utilization rates. The rapidity of this decline and the endpoint beyond which no glucose utilization could be detected varied considerably between the strains (data not shown).

Ethanol and yeast viability

Cell survival is a measure commonly used by microbiologists to assess the impact of a compound on a microorganism. It is known that ethanol affects the viability of yeasts in a concentration dependent manner, thus an assay that measures survival in high concentrations of ethanol should provide a way of assessing ethanol tolerance in wine yeasts. Furthermore, it was previously understood that ethanol-induced viability loss con-

tributes to reductions in productive capacity during wine fermentations.²⁰

Figure VI shows the effects of ethanol stress on viability of the five yeast strains studied for this article. Clearly there is a large separation between the most tolerant (the strain with the largest percentage of survival) and the least tolerant.

However, ranking of the strains according to their survivability following exposure to ethanol does not correlate well with other measures of ethanol tolerance described in previous sections of this article. Neither does the assessment of ethanol tolerance based on survival correlate with

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the performance of different yeast strains in model ferments (see next section). In fact, when aligned with the information in Table I, viability appears to be a very poor indicator of robustness for wine yeasts.

The above finding is consistent with current views on the importance of yeast

survival in wine fermentations. It is now thought that, contrary to earlier understandings of survivability of yeast during fermentation,²⁰ endogenously-produced ethanol does not impact on yeast viability, at least not until after completion of sugar utilization.¹² Therefore the impact of ethanol on the viability of yeast

in wine ferments may not be an important factor in determining successful completion of a ferment

Relating ethanol tolerance to fermentative performance

Apart from the assay for survivability, the measures of ethanol tolerance used in the work described in this article provide a consistent picture as to the relative ethanol tolerance of the five wine yeasts, but how do these findings relate to performance in fermentations?

Figure VII shows the sugar utilization profile of the same five strains used in previous experiments, in 100-ml model ferments. These ferments were performed in a modified Henschke and Jiranek-defined medium containing 100 g/L each of glucose and fructose, and 1.145 g/L ammonium chloride (equivalent to 300 mg/L of nitrogen). The ferments were self-anaerobic, being incubated with minimal shaking at 15°C until dry.

Under these conditions, some strains consistently out-performed others. Ranking the performance of these cultures in order of how quickly they fermented to dryness gives a similar pattern to what was observed in assays for ethanol tolerance. Furthermore, trials of these strains in industrial-scale fermentations reinforce this observation (Swiegers, AWRI, personal communication).

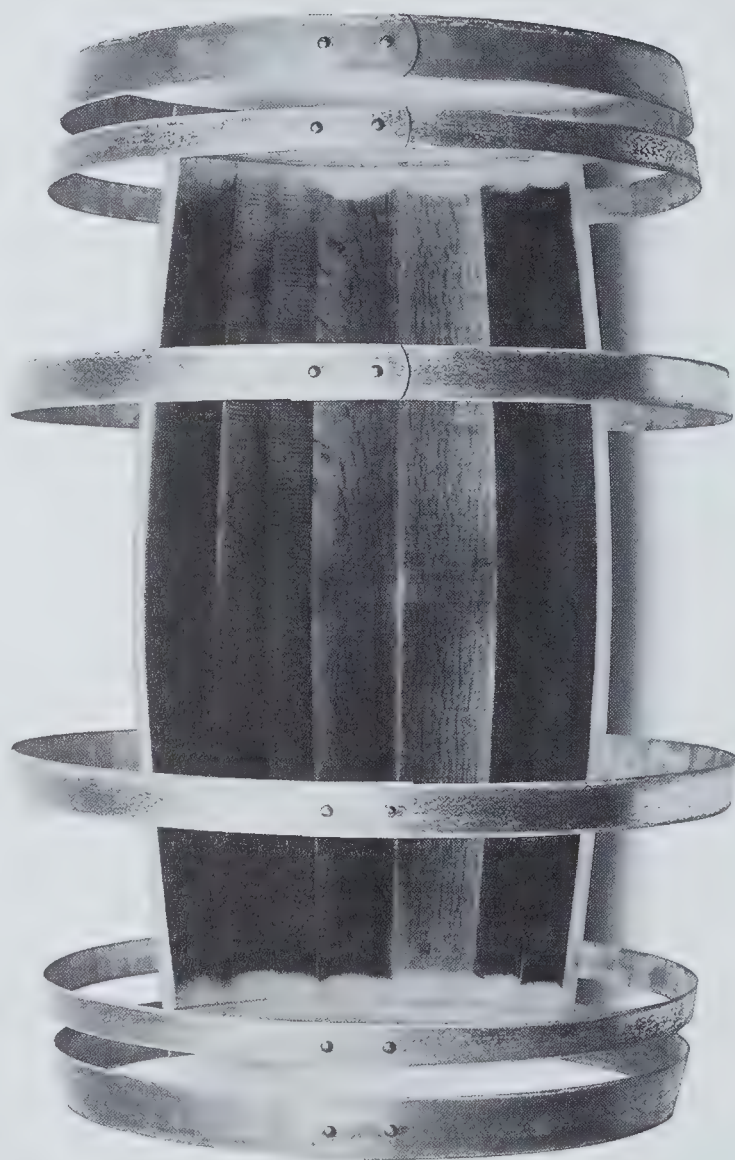
These correlations suggest that three of the four laboratory assessments of ethanol tolerance trialed in this work might be good predictors of fermentation performance for industrial yeast.

Conclusions and future directions

While it has been suggested that ethanol tolerance is an important indicator of yeast industrial performance, other than A. Zuzuarregui and M. L. del Olmo,³² there is little data to support this contention.

In this paper, we have shown that there are measurable differences in ethanol tolerance between yeast strains used in winemaking. Most of these differences appear to correlate with what has been reported about the robustness of these strains. Thus, we are now in a position to utilize these assays to identify "less robust yeasts" and can monitor their improvements in experiments designed to increase their resilience.

Variation in ethanol tolerance observed in these studies most likely represents genetic differences between the



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organisms used, such as ethanol tolerance is a heritable trait and is variable across strains. The idea that resistance to ethanol stress has a genetic basis is not new.¹⁷

Dissecting the genetics of ethanol tolerance is difficult, however, because the trait is almost certainly polygenic (determined or affected by many genes). Identifying and determining quantitative and qualitative contributions of the contributing genes will, therefore, be extremely difficult; a point highlighted by our level of understanding of this trait despite more than 40 years of research.

However, because there is a genetic basis to ethanol tolerance, and it varies from one yeast strain to another, it should be possible to improve the robustness of poorly performing yeast. This, of course, is particularly important for poor performers that have otherwise desirable attributes (such as contributing desirable sensory characters to wine).

Research currently underway at AWRI is harnessing adaptive evolution (a kind of selective breeding) approach to increase stress tolerance in strain-C (one of the poorer performing strains described in this article), which imparts very impressive sensory characteristics. Results to date are promising.

This research should provide future winemakers with an increased range of options when it comes to wine yeast selection. The AWRI aims to develop strains that not only have the capacity to provide sought-after flavor and aroma profiles, but will perform quickly and reliably in the winery. ■

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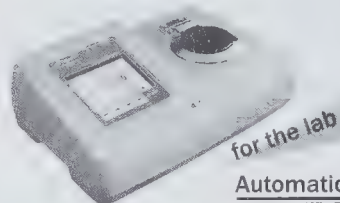
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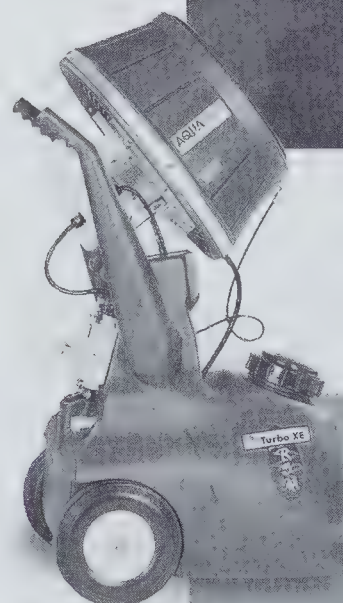


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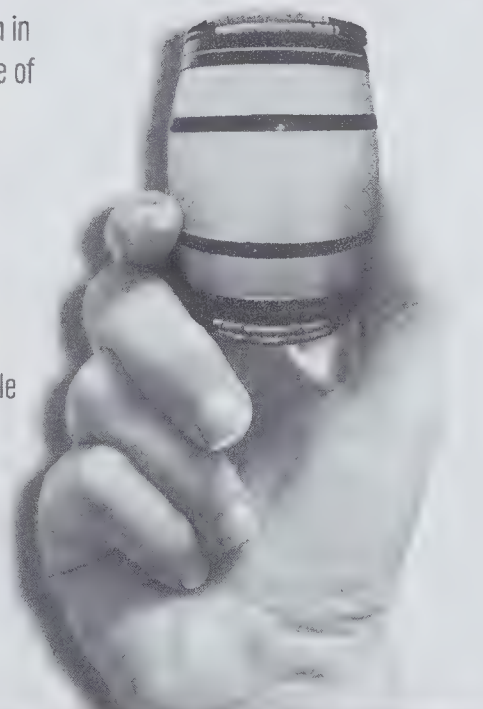
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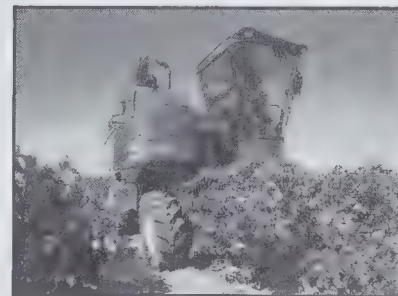
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CLIMATE IS CHANGING

in North Coast grape growing region

BY Zac Robinson,
Mendocino Winegrape &
Wine Commission

A review of long-term data from California weather stations in the North Coast grape growing region shows that significant

changes to the regional climate have occurred in the last 50 years. The changes are most dramatic in Napa and Sonoma Counties, where a gradual and persistent warming trend traces back five decades.

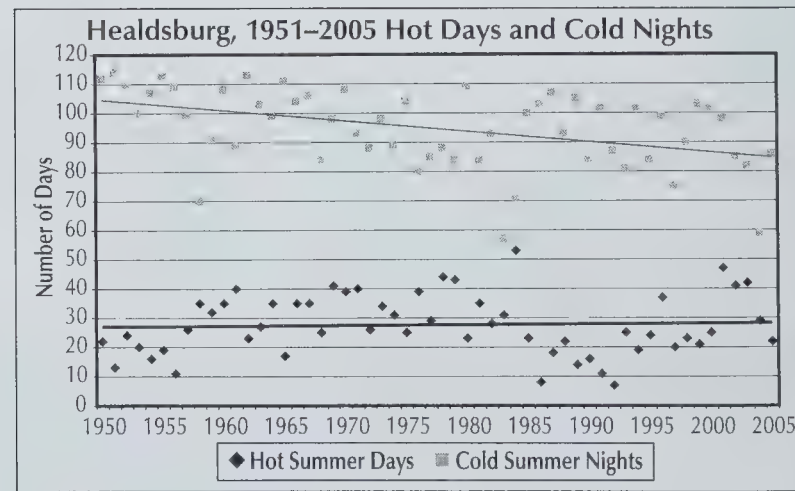
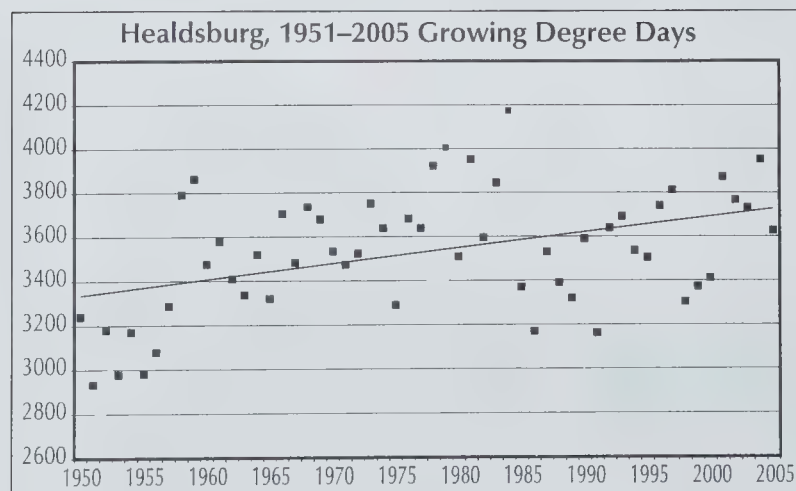
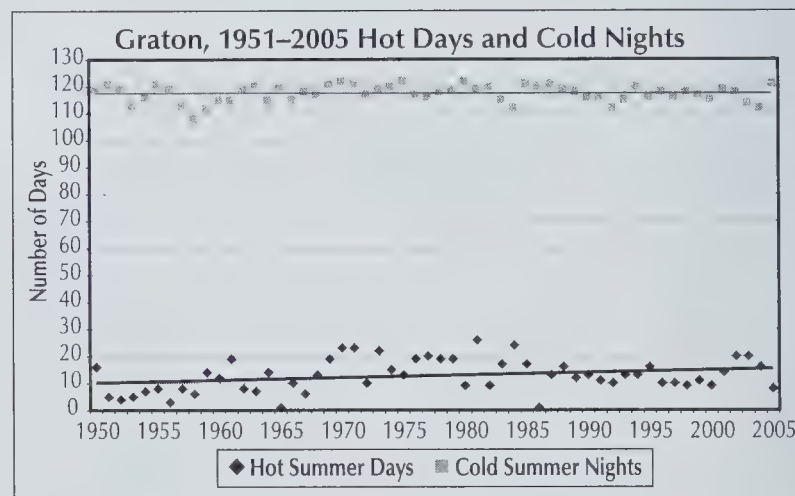
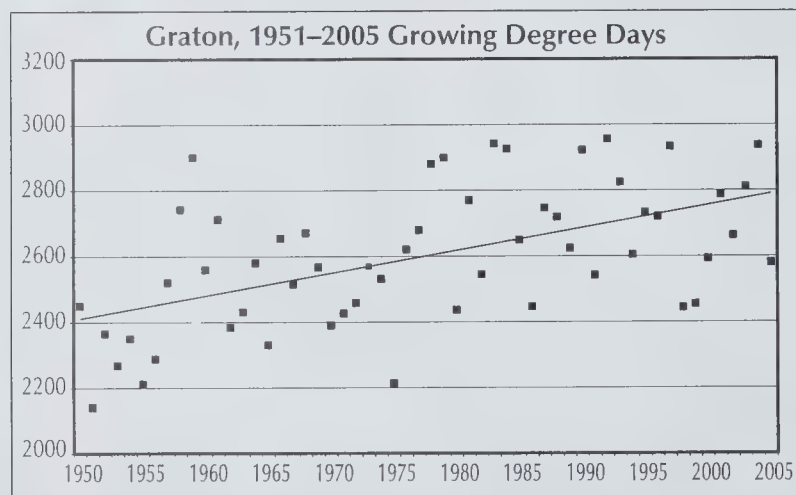
Further north, Mendocino County shows a trend of cooling over a similar

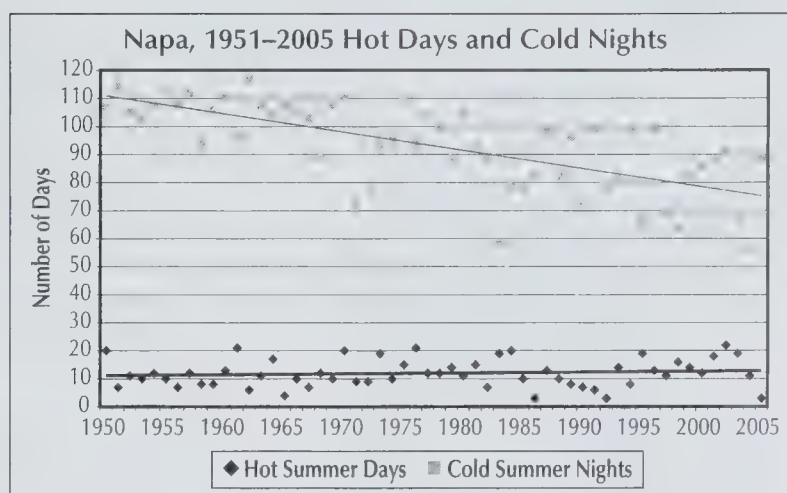
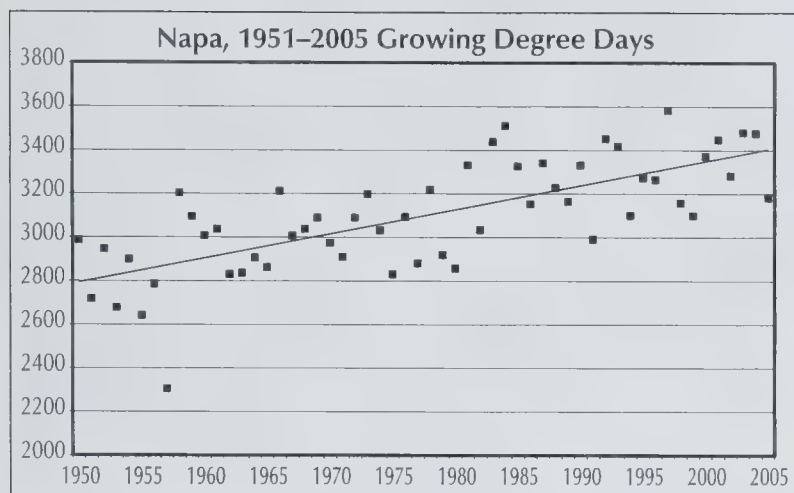
time period. These findings indicate that substantial changes to California's best known grape growing regions are underway and suggest that the best grape growing regions of the past several decades may not be the best grape growing regions in future decades.

Production of wine grapes in the North Coast (Napa, Sonoma, Mendocino, and Lake Counties) dates back to the time of the California gold rush. Ideally suited with its soils, climate, and proximity to growing wine markets, viticulture in the region has grown to become the dominant economic activity for the region.

There is no definition of a "perfect" climate for growing wine grapes. At the most basic level, the climate must offer enough warm days throughout the growing season to ripen wine grapes.

A.J. Winkler quantified this concept of heat summation and created a rule-of-thumb scale that identified five grape growing regions. Region I climates are the coolest and offer the lowest amount of heat summation, while





Region V climates provide a maximum amount of heat summation over the growing season. The North Coast grape growing region has found economic success as a region with cool to mid-range heat summation in its various microclimates.

While heat is desirable to help ripen grapes, excessive heat can be detrimental. Sunburn on both fruit and leaves is one obvious sign of damage during the hottest summer days. Both forms of sunburn can directly lead to inferior grape quality. Water stress, premature sugar ripening, and other undesirable outcomes can be attributed to hot spells during the summer ripening period.

Another factor that influences wine grape quality is cool summer nights. While warm summer days are needed to ripen grapes, cool nights are believed to improve the quality and suitability of wine grapes. Many microclimates of the North Coast successfully merge warm days with cool nights due to their proximity to the ocean and frequent fog intrusion in the summer.

The date of the last frost event marks the potential beginning of the growing season. This date can vary substantially from year to year. In some years the last frost may occur in February before grapevines have even started their growing cycle.

Other years may have a frost as late as May — which can be disastrous for the year's grape crop. For this reason

many North Coast grape growers use overhead sprinklers or other approaches to protect vines from spring frost events. In general, frost protection techniques are expensive and offer only partial protection at the coldest temperatures.

The four indicators of climate — heat summation, hot summer days, cool summer nights, and frost events

Winkler Heat Summation

Pioneered 35 years ago by A. J. Winkler [University of California, Davis], heat summation sums the number of degree days above 50°F during a typical growing season (April–October). Growing regions are ranked on the following scale:

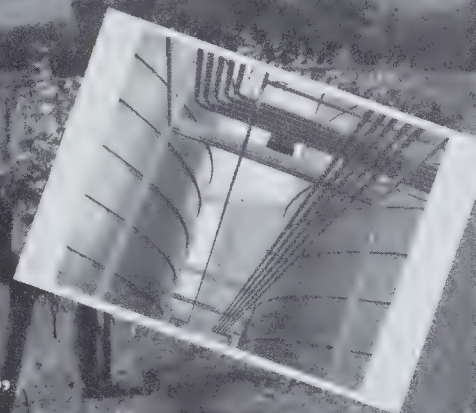
Region I: up to 2500 degree days
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 Region III: 3001 to 3500 degree days
 Region IV: 3501 to 4000 degree days
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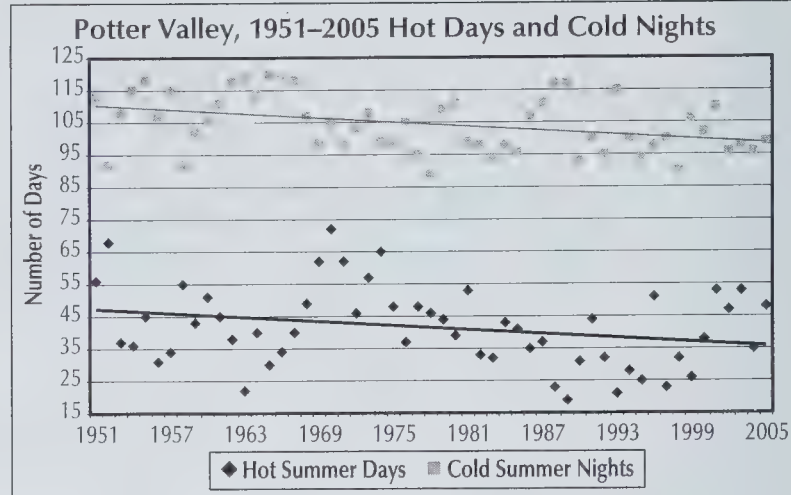
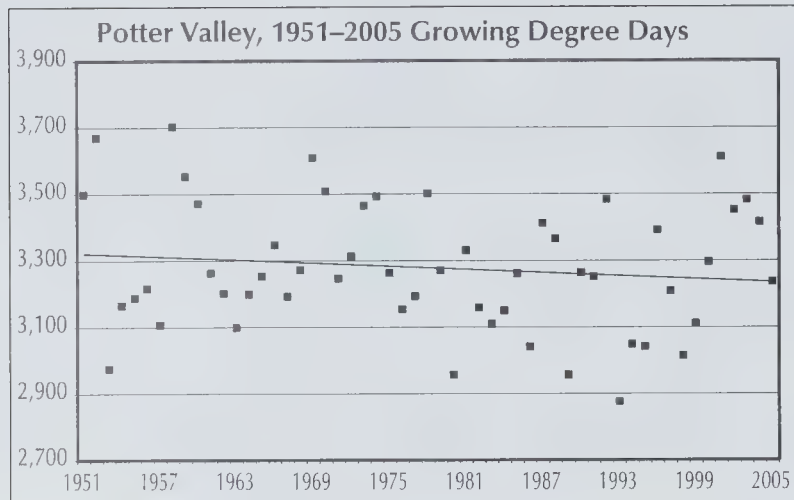
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— present only a partial picture of the suitability of a region to grow wine grapes. But each of these indicators can be easily measured and tracked over time so they make ideal parameters to measure climate change as it pertains to viticulture in the North Coast region.

Data used

Long-term temperature information from six weather stations was used in this research:

Napa [city], Napa Co. — 1951 to 2005

St. Helena [city], Napa Co. — 1951 to 2005

Healdsburg [city], Sonoma Co. — 1951 to 2005

Graton [town], Sonoma Co. — 1951 to 2005

Ukiah [city], Mendocino Co. — 1951 to 2005

Potter Valley, Mendocino Co. — 1951 to 2005

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With this temperature data, it is possible to calculate the following parameters to measure the suitability of a region to growing the highest quality wine grapes:

1. Annual heat summation from March 1 to October 31. Units = degree days. As a general rule, low to moderate amounts of heat summation are considered best for the highest quality wine grapes, although the optimal amount varies by grape variety. Example: Napa had a heat summation of 3181 degree days in 2005.

2. Annual count of hot summer days with daily high temperature equal to/above 95°F. Units = days. As a general rule, hot summer days are detrimental to growing quality wine grapes. Example: Ukiah had 53 hot summer days in 1955.

3. Annual count of cool summer nights with daily low temperature less than/equal to 55°F. June through September only. Units = days. As a general rule, cool summer nights are beneficial to growing quality wine grapes. Example: St. Helena had 65 cool summer nights in 1997.

4. Last spring frost event. Units = dates. As a general rule, earlier dates are beneficial to growing quality wine grapes. Example: The last spring frost in Ukiah 2005 was April 13.

Result: Napa and Sonoma Counties are warming

Heat summation data from weather stations in Napa and Sonoma Counties show a dramatic warming trend over the last 50 years. As an example, Napa (in the 1950s) would be classified as a Winkler Type II growing region with an average of 2821 degree days each

Lies, damned lies, and statistics

Climate "trends" are a muddled concept often prone to interpretation and debate. Because the weather in the North Bay appellation varies so much from year to year, we need statistical guidance to help us search for subtle trends within the historical record. In the field of climatology the issue is termed as "finding the signal in the noise."

In Ukiah — for example — there is typical year-to-year fluctuation of heat summation of about 190 degree days. In some years the fluctuation can be radical: a swing of 600 degree days was recorded in 1960–1961. The year-to-year variation is sometimes warmer and sometimes colder. Within this "noise" how do we find a cooling trend that averages a loss of 4 degree days each year?

Linear regression is the primary statistical technique used in this research. The math involved in the regression simply draws a line that best fits the "noisy" data. That linear regression line is provided on the graphs in this study.

The regression statistics also tell us the probability that the calculated regression line is simply a matter of chance. This figure is called the P value and the gold standard is a P value of 1% or less. At this level, the statistic indicates that there is a 99% chance that the trend is real and that year-to-year random weather fluctuations are not creating a false signal. The R^2 value shows the relative strength of the signal compared to the noise.

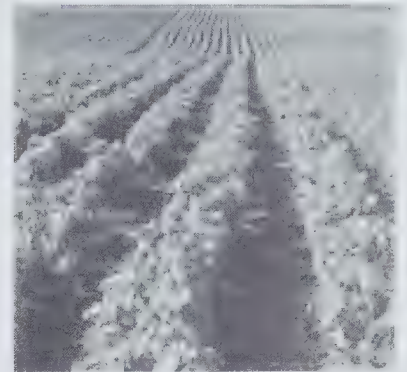
As for the final and most important questions — "What is the cause of the trend?" and "How should the wine industry respond?" — the science of statistics has no answers

Station	Last Frost 1950s	Last Frost 1996–2005	Statistical Change
Napa Co. — St. Helena	Mar 31	Feb 14	–1.4 day / year
Napa Co. — Napa City	Mar 26	Feb 16	–1.0 day / year
Sonoma Co. — Healdsburg	Mar 13	Feb 2	–0.8 day / year
Mendocino Co. — Ukiah	Mar 23	Mar 16	–0.5 day / year
Mendocino Co. — Potter Vly	Apr 18	Apr 6	–0.4 day / year
Sonoma Co. — Graton	Jan 14	Jan 9	–0.2 day / year

Station	Heat Summation Trend	Statistical Significance
Napa Co. — St. Helena	Warming: 83 dd each decade	Excellent: $P < 0.000$ ($R^2 = 32\%$)
Napa Co. — Napa City	Warming: 111 dd each decade	Excellent: $P < 0.000$ ($R^2 = 52\%$)
Sonoma Co. — Healdsburg	Warming: 71 dd each decade	Excellent: $P = 0.001$ ($R^2 = 18\%$)
Sonoma Co. — Graton	Warming: 69 dd each decade	Excellent: $P = 0.001$ ($R^2 = 28\%$)
Mendocino Co. — Ukiah	Cooling: 40 dd each decade	Good: $P = 0.015$ ($R^2 = 10\%$)
Mendocino Co. — Potter Vly	Cooling: 16 dd each decade	None: $P = 0.33$ ($R^2 = 2\%$)

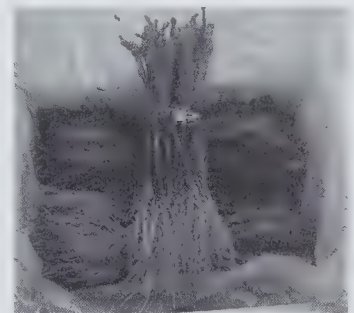


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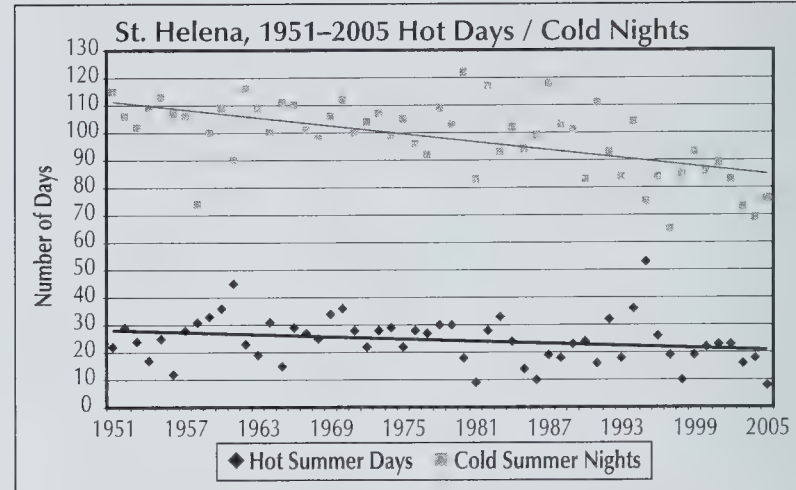
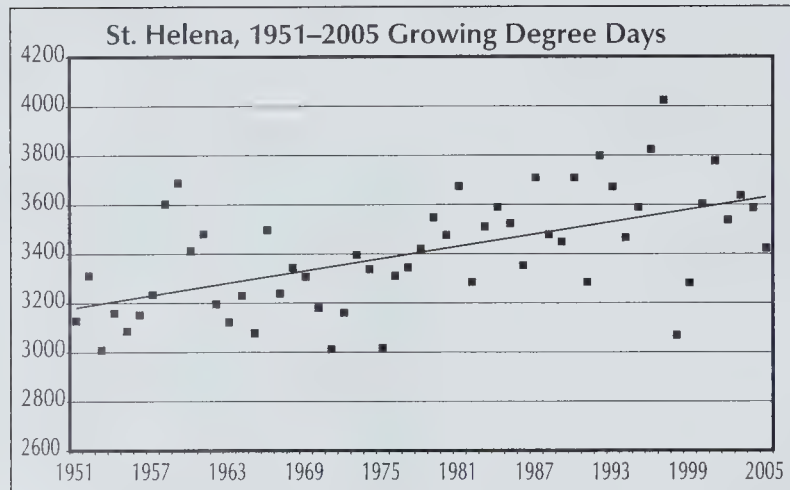
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year. But a consistent warming — growth of 110 degree days each decade — has changed Napa to a warmer Winkler Type III region over the last decade. For the 10-year period 1995–2005, the average annual heat summation is 3310 degree days.

A nearly identical trend is apparent in St. Helena, farther north in Napa Valley. Warming at a rate of 83 degree days each

decade, St. Helena has changed from a Winkler Type III region to a much warmer Winkler Type IV region.

In Sonoma County, the same trend is seen. The city of Sonoma has warmed 110 degree days each decade and the city of Graton has warmed by 68 degree days each decade. Graton, which is located near the Sonoma Coast, has warmed from a region I to a region II climate.

The average temperature in Napa and Sonoma counties is increasing because the nights are getting warmer. In other words, the region is losing its cool summer nights. The number of hot summer days in these regions is essentially unchanged over the last 50 years. But warmer nights have driven the Winkler heat summation (along with the average temperature) to unprecedented levels.

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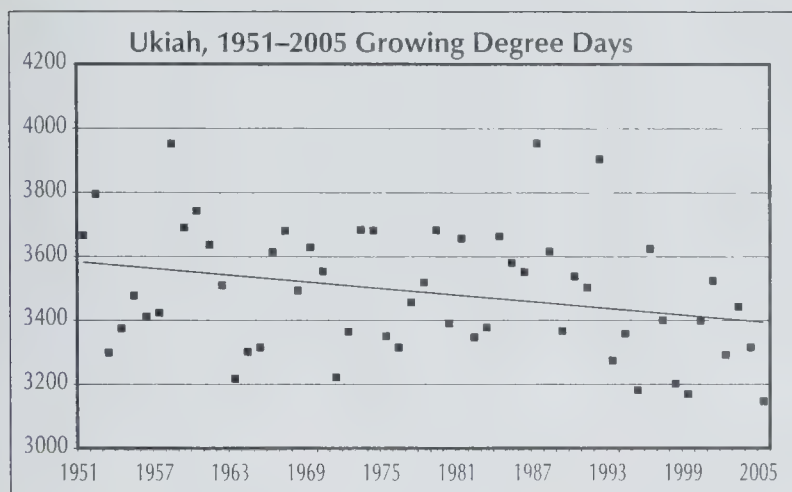
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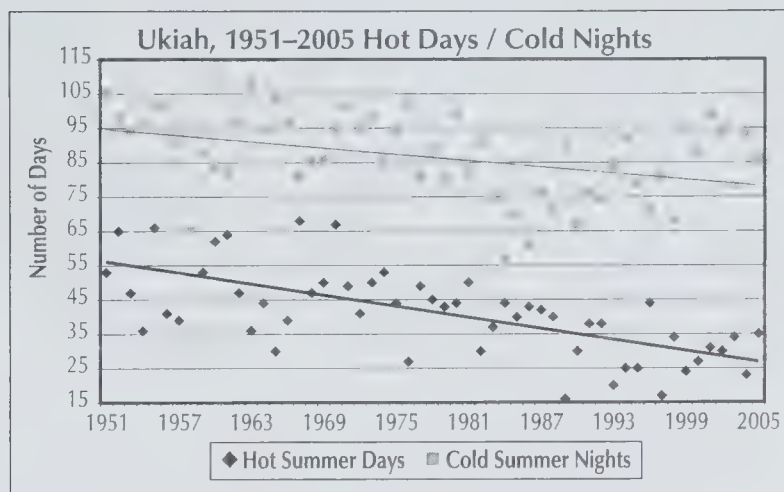
In the 1950s, Napa averaged 107 cool summer nights (June to September) annually where the temperature would drop to 55°F or below. In the last 10 years that average has fallen to 79 nights.

Result: Mendocino County cools

Long-term temperature data from two weather stations in Mendocino

show a very different picture: Mendocino County is cooling down. In the 1950s, Mendocino's Ukiah Valley was quite hot. With an average of 3583 degree days, the region was classified as a Winkler IV growing climate.

Subtle but consistent changes have been underway since that time. Losing an average of 40 degree days each



decade, Ukiah has cooled to a Winkler III region. A similar cooling trend is also apparent in Potter Valley (the location of the second Mendocino weather station used in this research).

The temperature data indicate that the cooling in Mendocino is driven by the declining number of hot summer days over 95°F. The decline is dramatic: in the 1950s, Ukiah averaged 51 hot

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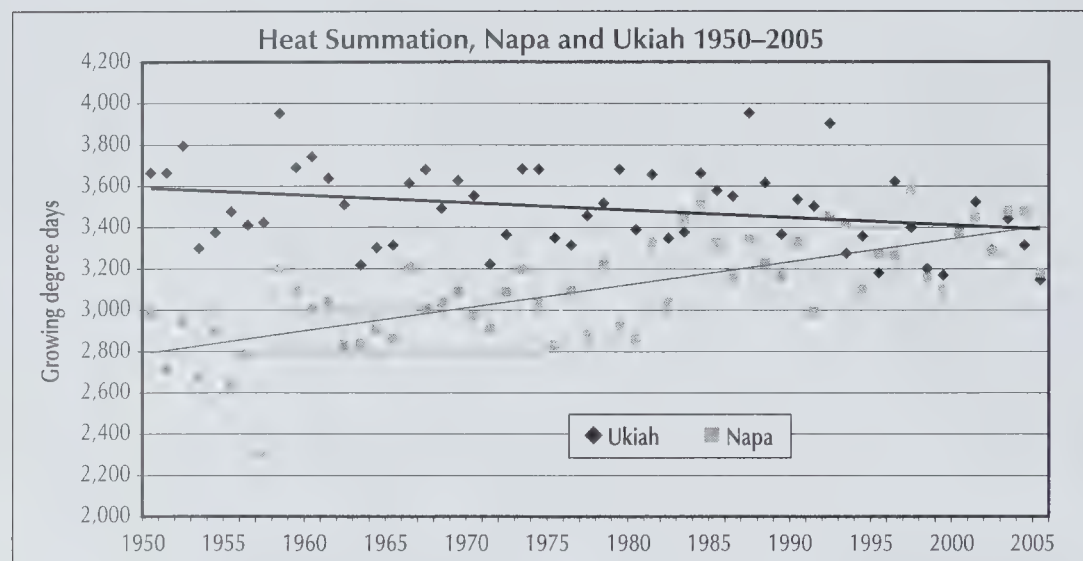
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days each year but the average figure for the last 10 years is just 29 days.

The overall cooling in Ukiah Valley has led to a transition when compared to Napa (Napa State Hospital weather station). Traditionally Ukiah has been about 700 degree days warmer than Napa. But as Ukiah has cooled and

Napa has warmed, the gap has closed completely. Ukiah has been cooler than Napa in the past three years.

Result: Spring frost events are disappearing

Across the North Coast the date of the last spring frost is occurring ear-

lier in the year. While the date of the last frost event still varies substantially year to year, the statistical average is moving earlier with each year at all locations studied. In Napa, Healdsburg, and St. Helena, the change is dramatic, as the last frost event is now more than one month earlier than in the 1950s. In fact, in these locations frost events after the grapevine bud-break (often in March) are becoming the exception instead of the norm.

Conclusions and caveats

This review of temperature data shows that several climate measures that affect grape growing have changed substantially over the last 55 years. Napa and Sonoma are now warmer growing regions and Mendocino is now cooler. Analysis shows that some of the trends — such as nighttime warming — are region-wide while other trends, such as daytime

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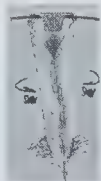
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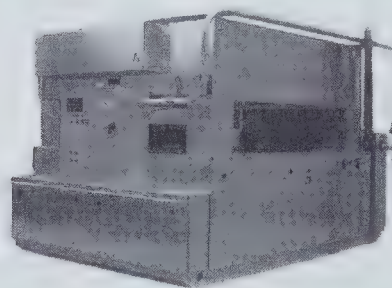
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cooling in Mendocino, are more limited in geographic scope.

The overall impact of these changes of wine quality is difficult to quantify although certain changes do have definitive effects.

The loss of the hottest summer days in Mendocino County is almost certainly a benefit to winegrape quality in this region.

The decline in spring frost events across the North Coast is an economic benefit to growers.

The warming of nighttime temperatures — especially in Napa and Sonoma — may have a negative impact on many grape varieties grown in these regions. However, it is also possible that these regions were previously too cold to successfully grow warm weather grape varieties (such as Cabernet Sauvignon) and that the new, warmer climate in these regions is better suited to the needs of these varieties.

The methodology used in this research has limitations that must be addressed by future research:

1. The cause of these climate changes is not known. Greenhouse gas warming is one likely possibility. Other possible influences, such as the Pacific Decadal Oscillation and other natural cycles, may also be relevant. This research does not prove or disprove any theory of the causes of climate change.

2. Climate changes discussed above are historic changes that have already happened. It is not known if the identified trends will continue into the future.

3. The use of the historical temperature record from a small group of weather stations requires great faith in the quality and consistency of data collected at these stations. Equipment changes, location changes, and even personnel changes may diminish the

validity of the temperature record at each station.

4. Urbanization has been shown to affect local temperatures. While none of the weather stations used in this research are in major metropolitan areas, some of the city stations (especially Napa) may be susceptible to "heat island" effects associated with urbanization. ■

Zac Robinson is a third generation family owner of Husch Vineyards, Philo, CA.

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Nine policy issues that will affect your business in the next decade

BY Robert P. Koch,
President & CEO,
Wine Institute, San Francisco, CA

This presentation summarizes nine important issues in the public policy arena that will have an impact on wine sales in 2007. The content is based on remarks given by Wine Institute President and CEO Robert P. (Bobby) Koch at the Unified Wine & Grape Symposium in Sacramento, CA in January.

Excise tax/Fees

The year following elections is typically the most dangerous for potential tax increases — in federal excise taxes and excise taxes in California and other states. Many states, including California, have multi-billion dollar structural deficits. California's last excise tax increase (\$.20/gallon/wine) was in 1991. Wine Institute staff is working on tax issues in Washington, D.C. and Sacramento, and the Wine Institute has 43 contract lobbyists in 38 states. It lobbies in all 50 states.

Many states are considering tax increase proposals on wine, beer, and/or spirits in 2007. States with proposed legislation include Connecticut, Hawaii (action deferred until 2008), Illinois (initial Cook County proposal was defeated in February), Indiana, Maryland, Maine, Missouri, North Dakota, New Hampshire, New York (also a New York City proposal), Oregon, Rhode Island, Vermont, Washington, and Wyoming (all three Wyoming bills have been defeated at this time). The majority of these proposals relate to earmarked taxes, where the revenue

from the increase would be directed to special programs or funding streams for specific programs, such as abuse and treatment programs. Wine Institute staff is working to defeat all of these proposals.

California's state government is funding many new programs with new fees. Wineries are paying new fees for water and air quality permits. In the legislature this year, the state's wine industry will face numerous "fee" bills — imposing fees on containers shipped from the state's ports, off-road diesel, employer/employee universal health care, and the local taxing option for emergency rooms or other services.

Self-distribution/Costco

Another related result from a U.S. Supreme Court decision has been the issue of self-distribution. Costco has challenged laws in Washington that allowed local wineries to self-distribute their wines to retail outlets, but prohibited those same retailers from buying directly from out-of-state wineries. Costco prevailed in court, and the Washington legislature passed a new law in 2006 opening that state up to unlimited self-distribution from U.S. wineries that obtain the required license.

This self-distribution issue was also addressed in other states, where the results for the wine industry were mixed. Wine Institute supported a solution in Vermont that allows any U.S. winery to self-distribute up to 2,000 cases of wine annually.

Four other states — Arizona, Maryland, Connecticut, and Massachusetts — passed self distribution bills that

included capacity caps limiting the size of wineries that can qualify for the licenses to self-distribute.

Even worse for local wineries, in 2006, five states — Delaware, Louisiana, Mississippi, Kentucky, and Virginia — took away the ability of in-state wineries to self-distribute entirely.

Virginia wineries went back to the legislature this year and a new statute has passed that will create a state-owned and operated wholesale entity that will handle distribution of up to 3,000 cases of wine for Virginia wineries unable to find traditional wholesaler representation.

Many other states are considering legislation that will either "level-up" or "level-down" by creating "level playing fields" that treat both in-state and out-of-state wineries the same.

The Costco case also dealt with a number of anti-trust claims based on various trade practice laws in Washington — this portion of the case is under appeal and it appears that an initial ruling from the Ninth Circuit may come in spring 2007.

Farm Bill reauthorization

The current Farm Bill expires in September 2007, and Wine Institute is working to ensure that attention and funding for research, conservation, promotion, disease/pest eradication, and export assistance are given to specialty crops (fruits and vegetables, tree nuts, dried fruits, and nursery crops) in the new Farm Bill.

Wine Institute is part of a coalition of groups working with key U.S. House members (Subcommittee Chair Dennis Cardoza, D-Calif.; John Salazar, D-Colo.; and Adam Putnam, R-Fla.) to develop language for a new bill, important for the wine and grape industry, that would promote sustainable farming and include wine in the definition of specialty crops, among other provisions.

Wine Institute has also worked with the California delegation, the U.S. Department of Agriculture, the Governor's office, and the California Department of Food & Agriculture to present its views on what the wine and grape industry would like to have included in the Farm Bill.

Wine Institute has testified jointly with the California Association of Winegrape Growers (CAWG) at Farm Bill field hearings — with CAWG Chairman Rodney Schatz in Lodi (August 2005), Ernest Gallo Jr. in Redmond, OR (August 2006), and Wine Institute Chairman Paul Dolan before the House Agriculture Committee's Subcommittee on Horticulture in Washington, D.C. (September 2006).

Hearings were to continue into the spring, and there is hope that a bill will be negotiated in committee by the House and Senate by the fall and see floor action before the end of 2007.

Immigration reform

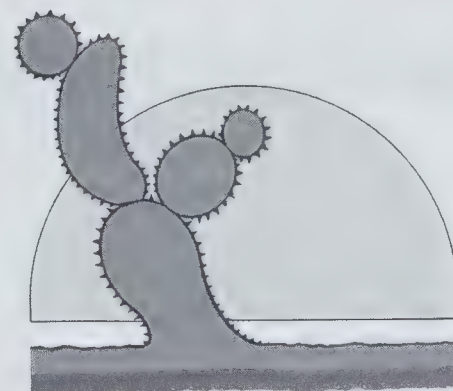
Legislative efforts to address immigration in a comprehensive manner in the 109th Congress were not successful. In the Senate, Edward Kennedy, D-Mass., and John McCain, R-Ariz., produced legislation that included a guest-worker program (reforming the so-called H-2A pro-

gram) and offered a "path to citizenship" for persons already in the U.S.

Their bill reflected two big-picture realities about immigration: 1) a market for these workers exists; and 2) no one in government has proposed a practical or humane way to repatriate millions of people who have been living here for years, working, marrying, raising children, and paying taxes.

President George Bush let it be known that he would sign the Kennedy-McCain bill, and the Senate passed it. But House Republicans, charging that the Senate was dealing with only half the problem, passed legislation providing only for tighter visa and border enforcement.

"Ag Jobs" is one piece of immigration reform that Wine Institute supports. Other immigration reform issues, such as increasing the number of temporary work visas for highly skilled foreigners (H-2B program), will also likely receive attention this year.



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INDUSTRY NEWS

AB32/Air emissions

This landmark California legislation has the potential of impacting every winery and vineyard owner. The Governor has challenging statewide goals to reduce CO₂, methane, and other "greenhouse" gases by 2020 to their 1990 levels. There are various unknowns because the law just went into effect the first week of January 2007.

Will all businesses, including all wineries, be required to reduce greenhouse gases? Will businesses be able to trade credits given the law's provision mandating *on-site* emission reductions coupled with indirect and cumulative impacts? Will wineries get credit for installing solar panels and other energy-efficient measures that establish their 1990 carbon footprint?

In preparation for these questions, Wine Institute is working with the research community on calculating carbon sequestration from vineyards to

quantify the positive impact that vineyards have on air quality.

Wine Institute and CAWG, through the California Sustainable Winegrowing Alliance, has introduced a new air quality chapter for its California Code of Sustainable Winegrowing workbook to provide the state's wine industry with best management practices for limiting air emissions. [See "Improving Air Quality," *PWV*, March/April 2007.]

Allergen labeling

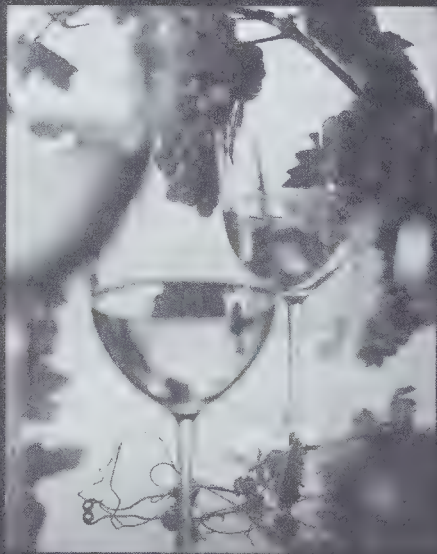
Congress passed the Federal Allergen Labeling and Consumer Protection Act of 2004, requiring food products to bear labels for the presence of allergens. Despite the tentative state of analytical science in testing for the presence of allergens, the Tax & Trade Bureau (TTB) proposed new regulations to implement the Act for alcoholic beverages at: www.ttb.treas.gov/wine/wine_rulemaking.shtml.

TTB's proposed rule would mandate a "Contains [name of allergen]" statement on all alcoholic beverage labels if an ingredient or processing aid that contains any of eight listed allergens is used during production.

The proposed rule provides a procedure to exempt a product class from the labeling requirement, but only if the producer of the product can prove 1) that the allergens used in production and that remain in the finished product will not cause an adverse reaction, or 2) that the allergens used in production no longer remain in the finished product.

The proposal will not require TTB to show that allergens are present in wine; instead, wineries are required to prove that allergens are NOT PRESENT in wine for an exemption. TTB's public comment period closed December 26, 2006.

This is one rulemaking situation where TTB does not have a lot of lati-



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tude. It must pass regulations that are consistent with the Act.

Winemakers might use several processing aids that are generally regarded as allergens:

- Milk — used as fining agent, to remove off-flavors, for TCA control;
- Eggs — albumen, a fining agent;
- Fish — isinglass (made from fish bladders), to clarify wine.

Wine Institute's public comments included several suggestions about the rule. First, the Institute believes that use is not the same as presence, and that the labeling requirement should not be triggered merely by use.

Wine Institute believes that compelling a winery to state that its product "contains" an allergen when it might not is misleading. Wine Institute also suggested changes in the exemption process so that both the regulators and the industry can agree on the standard of proof and the science necessary to prove an exemption.

Allergens are difficult to detect in small quantities, and analytical methods vary considerably in their sensitivity, cost, and accuracy. Shifting the burden of proof to producers without proposing provisions on acceptable testing methods is an issue the Wine Institute wants to remedy.

Wine Institute's next step is to proceed with an exemption petition for some of the major wine fining agents. Wine Institute staff has been in touch with scientists and the TTB Lab, and hopes to formalize a testing protocol that will be acceptable to TTB, and then to proceed with testing and data collection.

Serving facts/ Ingredient labeling

In 2007, the wine industry expects TTB to publish a Notice of Proposed Rulemaking on "serving facts" labeling. This rulemaking would propose provisions that may require alcoholic

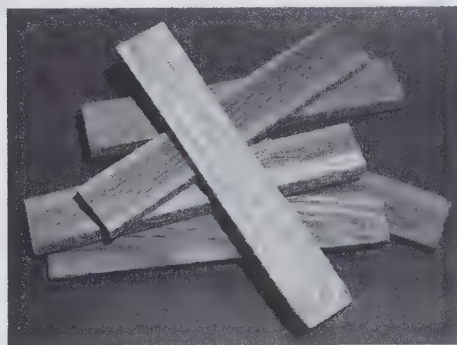
beverage labels to have a panel that contains certain "facts" about a serving of the product, including serving size, alcohol per serving, and number of servings per container. A separate rulemaking on ingredient labeling is scheduled for release after the proposed "serving facts" rule is issued.

In the summer of 2004, TTB published the second of two white papers, which was intended to precede a formal ruling outlining the standards for such "serving facts" labeling. Many members of the industry, including Wine Institute, urged TTB to cancel its plans for a ruling and instead to proceed with formal rulemaking.

TTB then published an Advance Notice of Proposed Rulemaking in 2005 where it received comments on several subject areas: ingredient labeling, nutrition labeling, "alcohol facts" labeling, voluntary "serving facts" labeling, and allergen labeling.

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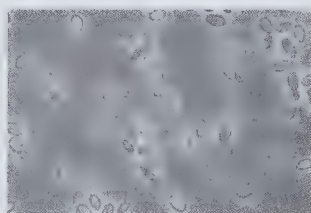
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INDUSTRY NEWS

Wine Institute will wait to see what TTB proposes on labeling, but the Wine Institute position will remain consistent with previous positions on labeling:

- Wine Institute continues its opposition to ingredient labeling;
- Wine Institute is in favor of TTB making efforts to harmonize its labeling requirements with those of other major producing nations, and with those of other federal agencies, especially the FDA;
- Wine Institute has been and continues to be opposed to mandatory nutrition labeling (such as carbohydrates, calories, fats, and proteins) but will await further rulemaking proceedings on the issue and revisit this issue with its membership;
- Wine Institute is opposed to the use of drinks comparison or "equivalency" graphics; and
- For the same reasons that Wine Institute opposes the graphics, it also opposes references to a "standard drink."

Pierce's disease/ Glassy-Winged Sharpshooter containment program

Vigilance is the operative word when dealing with Pierce's disease. California is in the second year of the first five-year extension of the law that currently assesses all winegrapes at \$2 per \$1,000 of value. The industry's annual \$3 to \$5 million assessment is vitally important to securing the \$4.34 million from the state's General Fund and the approximate \$21 million from the USDA for research and containment.

Direct-to-consumer shipping

Since the U.S. Supreme Court's Granholm decision (May 2005), Wine Institute has seen the number of states with workable direct-to-consumer (DTC) legislation increase from 26 to 34 states. The change in adult population available for sales in these states represents an increase from just over 50% to over 80% of the potential U.S. population.

At this writing, three more states (Indiana, Kentucky, and Massachusetts) have passed legislation that has yet to result in Wine Institute advising its members to ship because of regulatory hurdles in the bills.

Another result of the Supreme Court ruling has been the need to transition the popular "reciprocity states" over to "permit states." California was the first to act on this in 2005, and six of the 12 remaining reciprocal states transitioned over in 2006.

The 2007 year is going to see more action, with transition to permit legislation expected in major shipping states such as Oregon and Illinois.

A major effort will also be undertaken to preserve the wine industry's shipping privileges in Florida, where opponents may continue to push for restriction, including capacity caps that would exclude a large portion of the industry.

Litigation is currently underway challenging restrictive provisions of some of the laws that were passed, such as the capacity caps and exclusions for wineries with wholesalers that are part of the Arizona and Massachusetts DTC laws. ■

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Grape and Wine Tannins

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Grape tannins and anthocyanins are important fruit quality components that contribute to the color and taste of red wines. Tannins contribute to the mouthfeel of wine, and they also form pigmented polymers in association with the anthocyanins to provide wine with the stable pigments required to give red wine long-term color stability. Tannins and anthocyanins are also antioxidants that are considered by many to be beneficial to human health.

Winemakers understand the importance of tannins to red wine quality and, because of this, spend considerable time empirically developing methods that are useful in managing their quality of red wine.

Wine producers in the U.S., Australia, and many European countries have invested considerable money on research targeted toward understanding the nature of tannins in the grape as well as their extraction

during wine production, and modification during wine ageing.

Such global attention indicates that there is a strong commitment to developing objective methods for tannin quality management in the vineyard and winery. This paper summarizes some of the recent global findings in tannin biochemistry and chemistry.

PRODUCTION Biosynthesis

In the scientific literature, the specific class of tannins found in grapes is

generally referred to as condensed tannins or proanthocyanidins. In most red wines, nearly all tannin present is grape-derived, and therefore belongs to this class of tannins.

Operating on the premise that grape production practices have a tremendous impact on the quality of red wine astringency, scientists have spent much time studying tannin biosynthesis and structure in the grape.

Grape tannins are polymers composed of similarly structured phenolic subunits joined together like a chain. In grapes, tannins can have variation in the specific subunit type as well as variation in the polymer length.

Both the skin and seeds of grapes contain significant amounts of tannin, but the type of tannin polymer is different in the two tissues. Grape skins contain longer polymers, on average around 20 to 30 subunits in length in ripe fruit, whereas the tannins in grape seeds are normally shorter, averaging four to six units long.^{35,41}

The subunits that make up the tannin polymers are synthesized in plants via the flavonoid pathway, which also produces the anthocyanins responsible for red wine color (Figure 1). Because anthocyanins are of considerable importance in many plant products (such as flowers and fresh or processed

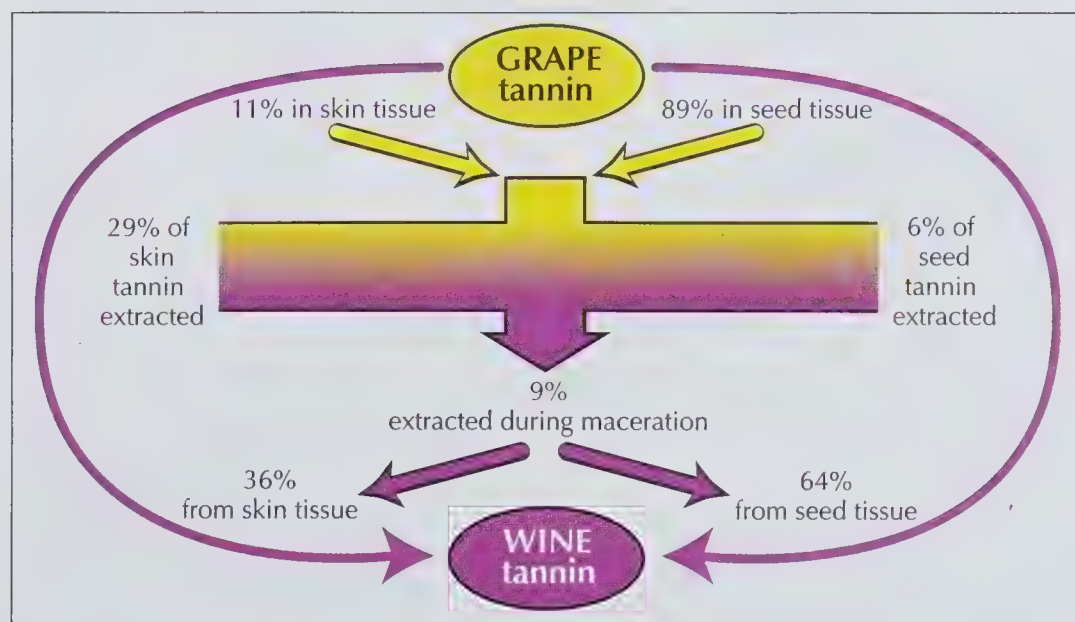
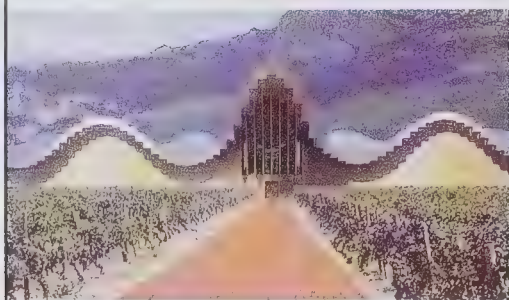


Figure IV. Schematic representation of skin and seed tannin extraction during maceration. The numbers indicated in this schematic are based upon an actual experiment conducted on cv. Pinot noir. Grape seed tannins exceed those found in the skin tissue and overall, a small portion of the overall quantity of tannins found in the grape is extracted during wine production. Finally, the maceration favored the extraction of skin tannins over seed tannins.

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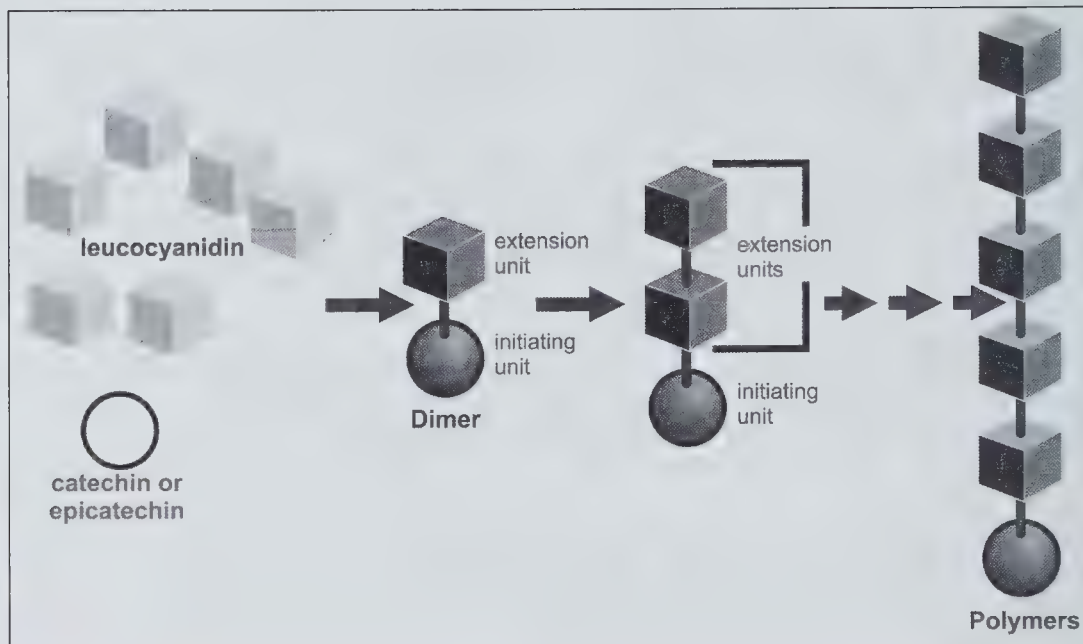


Figure II. Schematic representation of the formation of tannin polymers. An initiating unit, generally catechin or epicatechin in grapes, joins with an extension unit derived from leucocyanidin to form a dimer. Sequential addition of further extension units results in progressive elongation of the polymer.

fruits), this pathway has been extensively studied, and the biochemistry of anthocyanin biosynthesis is reasonably well understood.

The flavonoid pathway consists of a series of sequential chemical reactions that process intermediates along the pathway progressively, like a chemical production line. Each of these chemical reactions is carried out by a specific enzyme (indicated in Figure I). The chemical structures of the tannin subunits are similar to those for anthocyanins, and the syntheses of anthocyanins and of tannins share common steps in the flavonoid pathway.

The genes that direct production of the enzymes that carry out these shared steps (CHS, CHI, F3H, DFR, and LDOX) and the last step (UFGT), which is only required for anthocyanin synthesis, have been known for some time. By studying the expression of these genes during grape berry development it has been possible to determine how the flavonoid pathway is regulated in grapes.³

The UFGT gene is only expressed in red grapes and only after veraison, when anthocyanins are being made in the skin. As expected, the shared genes in the flavonoid pathway are also expressed in Shiraz grape skins after veraison, as they

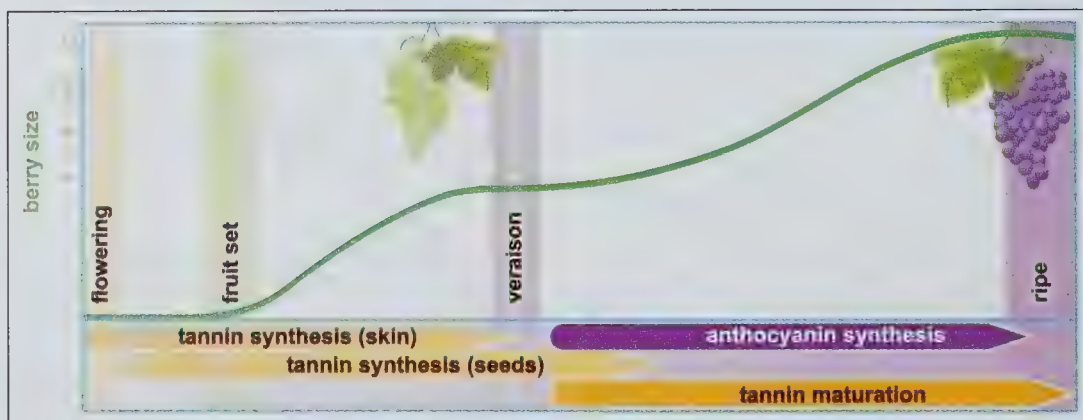


Figure III. Anthocyanin and tannin production during grape berry development and ripening. Berry size is illustrated by the green curve showing the two phases of berry growth between fruit set and veraison, and after veraison when the berries are ripening. Tannin synthesis starts very early in berry development and continues until veraison in skin and for 1-2 weeks after veraison in seeds. Tannin maturation, resulting in decreased extractability of the tannins, occurs during ripening. Anthocyanin synthesis occurs in the skin of red grapes after veraison, and after tannin synthesis is complete.

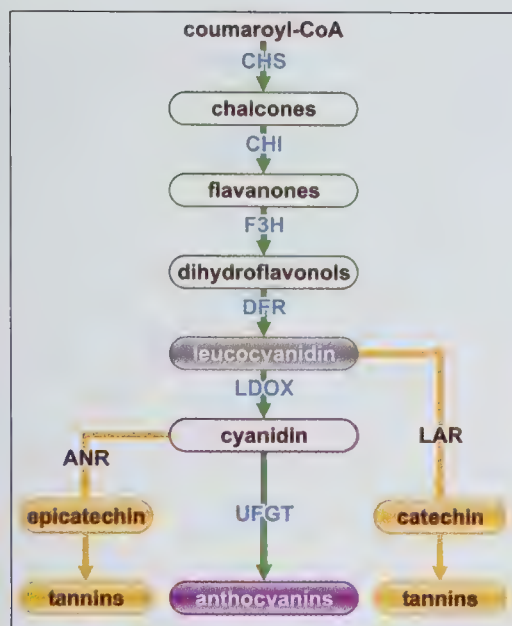


Figure 1. Schematic representation of the flavonoid pathway leading to the production of anthocyanins and tannins in grapes. Each step in the pathway is carried out by a specific enzyme, shown in blue for the general pathway and black for the two tannin steps. Leucocyanidin is thought to be the source of the extension units that make up the tannin polymer (described below) but also gives rise to catechin, one of the initiating units. The other initiating unit, epicatechin, is derived from cyanidin. The enzymes are: CHS = Chalcone Synthase; CHI = Chalcone isomerase; F3H = Flavanone-3-hydroxylase; DFR = Dihydroflavonol reductase; LDOX = Leucoanthocyanidin dioxygenase; UFGT = UDP-glucose: flavonoid glycosyltransferase; LAR = Leucoanthocyanidin reductase; ANR = Anthocyanidin reductase.

are part of the anthocyanin production line. However, these shared genes are also expressed prior to veraison, when UFGT is not expressed and no anthocyanins are being made.

These shared genes are highly expressed early in berry development just after flowering, and it has been suggested that this activity is related to the pathway being switched on to produce the colorless flavonoids, such as flavonols and tannins.

While the pathway for making anthocyanins is reasonably well-established, the steps involved in tannin synthesis are not all known as yet. Tannin polymers contain an initiating subunit and several extension subunits, but the exact mechanism by which these polymers are formed is not yet clear. One possible mechanism for tannin polymer formation is shown in **Figure II**.

The initiating unit (generally one of the two flavan-3-ol stereoisomers, catechin or epicatechin) combines with an extension unit, another intermediate of the flavonoid pathway (an activated form of leucocyanidin), to form a dimer.

The sequential addition of more extension units results in the tannin

polymer increasing in length. Thus to make tannin polymers, the plant requires initiating subunits (such as catechin and epicatechin) and a source of extension units, which are probably derived from leucocyanidin. Production of longer tannin polymers, as occurs in grape skins, would obviously

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require the production of many extension units for each initiating unit.

Recent discoveries in other plants provide some clues to the early steps in tannin production in the synthesis of the initiating subunits. It was previously predicted that a catechin-initiating unit is generated by reduction of the leucocyanidin via an enzyme called leucoanthocyanidin reductase (LAR) as shown in **Figure I**. The existence of this enzyme has now been firmly established, the enzyme has been purified, and the gene that encodes it has been identified.⁴²

A second, hitherto unknown pathway to form the initiating units has been discovered in the seeds of a plant called *Arabidopsis*. This alternative pathway involves reduction of anthocyanidins (such as cyanidin in **Figure I**) to produce epicatechin via an enzyme called anthocyanidin reductase (ANR), and the gene that codes for this enzyme has also been identified.⁴⁸

We have now identified the grape versions of the genes encoding both LAR and ANR, and this provides new tools to unravel how tannins are made in grapes. Application of these tools has provided new insights into when and where tannins accumulate during berry development and ripening.

It is now clear that there are two important phases of tannin development in grapes: tannin accumulation, between flowering and veraison, and tannin maturation, after veraison when the berries ripen.

Accumulation

On a weight basis, the concentration of tannin is very high in many developing fruits just after flowering, and this is thought to discourage herbivores from eating the flowers and fruit before the seed has matured and become viable. Consistent with this, grapes contain high concentrations of tannin early in fruit development.^{11,22,23}

More recent studies on Shiraz grapes have focused on the early stages of berry development.² These findings indicate that the tannin concentration on a weight basis is highest in the earliest stages of berry development. Once fruit growth starts, the berry increases in size dramatically. The tannin concentration of grapes is maintained during this phase suggesting continued synthesis of tannin to keep up with the growth of the fruit.

Accumulation of tannins in the skin and seeds of the berry is somewhat different. In the skin, tannin levels increase after berry set, reaching a maximum at one to two weeks before veraison.^{2,11} Based upon gene expression studies, tannin synthesis in the skin of the developing grape berry is most active between flowering and fruit set and is completed before veraison.

In the seeds, the concentration of tannins increases after fruit set, reaching a maximum at one to two weeks after veraison. Expression of the tannin genes

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also increases during this time and peaks at veraison then declines to very low levels two to four weeks after veraison.

Tannin synthesis in seeds continues after veraison, and this coincides with maturation of the seed coat and its change in color from green to brown. In both seeds and skin, there is no tannin synthesis during the later stages of berry ripening when extractable levels of tannin actually decline.

Perfection

Understanding how the perception of tannin in a grape berry at veraison is transformed into perceived tannins in a fine red wine has been the subject of research by many groups throughout the world. This process of perfecting tannins takes place both in the vineyard and in the winery.

Tannin changes during fruit ripening

Tannin concentration in a number of fruits declines during fruit growth and

ripening, so the fruit becomes more palatable to herbivores, which will ingest the fruit and aid in dispersing the mature seeds (Figure III). In part, this decline in tannin concentration during development is the result of fruit growth.

If tannin synthesis occurs very early in fruit development and then stops, the tannin is diluted out as the fruit grows. However, the total amount of tannin per fruit may also decline, suggesting that tannin is degraded or becomes less available for extraction.

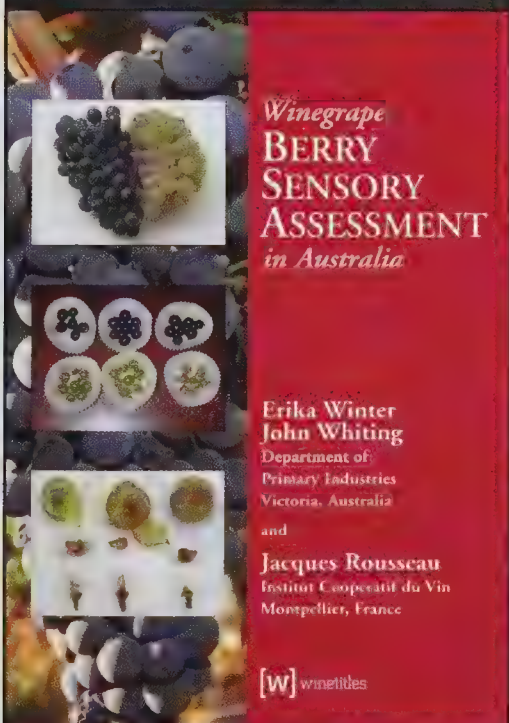
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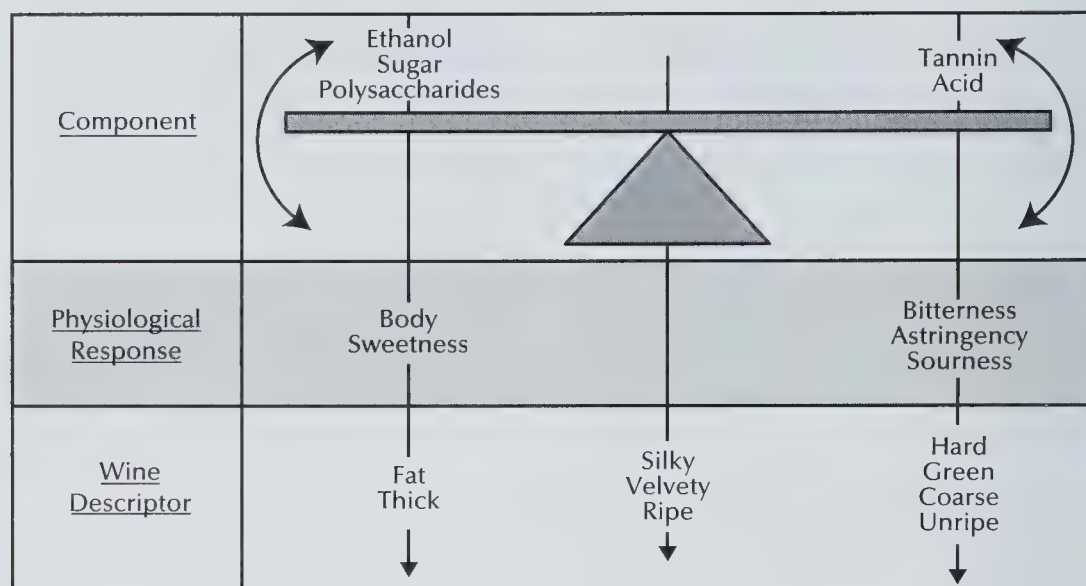


Figure V. Schematic representation of the formation of tannin polymers. An initiating unit, generally catechin or epicatechin in grapes, joins with an extension unit derived from leucocyanidin to form a dimer. Sequential addition of further extension units results in progressive elongation of the polymer.

It is generally accepted that tannins are not chemically broken down to any great extent during fruit ripening; they just become more bound up within the fruit tissues and are less easily extracted.

In grapes, many studies have observed a significant decrease in tannins after veraison, indicating that the tannins are being modified and are no longer readily extracted.^{8,11,22,23} This is also observed in fruit quality assessment by winemakers, who are often looking for tannins to ripen or soften in the later stages of berry ripening.

It is not clear what causes this decrease in extractable tannin. Continual growth of the tannin polymers to produce longer chains could decrease their extractability, but measurements of the mean degree of polymerization, a measure of chain length, indicates that the seed and skin tannins do not get appreciably longer during the tannin maturation phase.¹¹ It seems more likely that the tannin polymers become chemically associated with other compounds in the berry during fruit ripening.

The tannin composition of fruit and its influence on wine depend on the type and amount of tannins synthesized in the grapes and the extractability of these tannins when the fruit is harvested.

Climatic conditions and viticultural management during the early part of

the season may influence both the amount and type of tannins synthesized, although the nature of these interactions are not yet well defined.

Vineyard practices that have been found to influence the tannin composition and amount in grapes at harvest include irrigation,^{22,30} vigor,⁷ vintage,³¹ altitude,²⁸ and shading.^{7,12} Despite these findings, it is still unclear whether these influences are due to light, temperature, or other factors. Further investigations are required to determine how these climatic and viticultural factors influence tannin composition of grapes at harvest.

What does seem apparent is that, beyond the potential quantity of tannin in the grape at harvest, there currently are very few compelling observations to explain, from the perspective of tannin structure why the perception of tannins in red wine is so profoundly influenced by grape production practices.

One explanation suggests that the grape tannins of the lowest molecular weight decline during maturity, and these tannins are responsible for the harsh bitterness found in some wines.²²

Another potential explanation suggests that, in red wine, the proportion of grape skin tannin to seed tannin changes as a function of maturity and cultural practice, and perhaps an increase in the proportion of skin tan-

WINEMAKING

nin relative to seed tannin in red wine explains the qualitative improvement in perceived tannins. Beyond these structural explanations for tannin quality improvement, most of the evidence for astringency improvement remains with the non-tannin changes that occur during fruit ripening. These potential explanations will be explored in the following sections.

Tannin extraction during wine production

Once grapes are harvested, tannin composition in the wine depends upon processing in the winery. Under most winemaking operations, the skin and seed tannins make up the vast majority of the tannin pool present in wine. If they are included, stem-derived tannins are a minor component.

Determining the total quantity of tannin extracted during wine production is under the winemaker's control, but determining the relative proportion of seed and skin tannins present in the final wine is much more difficult to control.

It is generally thought that skin-derived tannins are riper than those found in the seed, and that the sensory impact or extractability of seed tannins diminishes as fruit gets riper.

Using a recently developed analytical method, Pastor del Rio and James Kennedy found that wine made from increasingly mature grapes resulted in an increase in the proportion of seed-derived tannins.³⁴ This observation is inconsistent with general wine industry explanation for tannin quality improvement with fruit maturity.

Additional research does suggest, however, that a wine with more skin tannin (amount and proportion) has more desirable tannin, and this may provide some explanation for wine tannin quality improvement.⁶ Given this observation, and despite the evidence to date indicating that maturity does not increase skin tannin proportion, an improvement in tannin quality should be observed with an increase in the proportion of skin tannins found in wine.

Skin tannins are generally extracted early in fermentation, and as the maceration time increases, the rate at

which seed tannins are extracted increases.³⁴ Tannin extraction will increase throughout fermentation, so in theory, at some point seed tannin would dominate the total quantity of tannin present in the wine.³⁶ The trick, from a winemaking perspective, would be to optimize not only the quantity of tannin extracted, but also the ratio of skin to seed tannin.

In the final wine, the skin and seed tannin proportions are generally different than those found in the berry (Figure IV). In addition to grape maturity and maceration time, conditions in the vineyard^{6,7} have been found to influence the proportion of skin and seed tannin in wine.

In an unpublished recent experiment, it was found that the degree of berry crushing influenced the relative extraction of skin and seed tannins, with the proportion of skin tannin extraction increasing more rapidly than seed tannin extraction up to about 50% crushed fruit and after 14 days of maceration time. When crushing exceeded 50%, seed tannin extraction increased more rapidly than skin tannin (Kennedy et al., unpublished).

Understanding the consequence of tannin amount and composition from a perception standpoint is the long-term key to understanding the best strategies for managing red wine quality both in the vineyard and in the winery.

The next section summarizes tannin structure and perception along with other aspects of red wine composition that influences our ability to perceive tannins.

Perception

The complexity of tannin perception in red wine is best appreciated if we begin with the core of its sensory contribution: astringency.¹⁹ Tannins are compounds that seem to be designed by nature to be deterrents to herbivores and fungi. Tannins accomplish this because of their ability to bind strongly to proteins.¹⁸ In wine, it is generally considered that we experience this as a loss of lubrication in the mouth when tannins bind with and precipitate our salivary proteins.

To put it simply, tannins are astringent, terribly astringent.^{15,29} Astringency



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is a tactile sensation and therefore, we *feel* it. This gives rise to the common term used to describe tannins in wine: mouthfeel.

Beyond astringency, tannins can also possess bitterness, which is a taste sensation caused by the lowest molecular weight tannins.^{1,21,43,33}

Generally, too much bitterness in wine is not desirable, and based upon the reduction in the lowest molecular weight tannins observed during berry maturation, this may provide a structural explanation for why tannin quality improves with fruit maturity.

Considering tannin perception in total, the perception of tannin astringency has a distinct temporal aspect.^{20,44,26} When wines have an excess quantity of tannins, the astringency can linger beyond that of other components. This persistence is generally thought undesirable.

Although bitterness and astringency are found in red wines, they are not descriptors that are often used in a production setting. Instead, winemakers tend to describe tannins in more complex terms. Sensory scientists and chemists have spent considerable time trying to understand these more complicated aspects of tannin perception.^{5,16,17,27}

From these investigations, it is clear that the perception of astringency in wine can be influenced by many wine components, including ethanol,¹⁴ acidity,^{14,32} viscosity,⁴⁰ polysaccharides^{37,45} and anthocyanins.⁴⁶

There are tools being developed in the winery that affect tannin perception.¹⁰ These studies are quite difficult to conduct because of the variation in human response to astringency and bitterness.¹³ Moreover, the complex interaction between tannins and other macromolecules found in wine indicates that fully understanding the nature of tannin perception will continue to be a challenging area of research.^{9,37,39}

Perhaps a good way to conceptualize tannin perception and the relationship between tannin description and grape composition is to think about how different grape components influence our perception of tannins (**Figure V**). Here tannins and acid are balanced with ethanol, sugar, and polysaccharides. As a winemaker, the goal is to balance these components in a red wine.

California Oregon Washington Idaho Utah

Initially, when grapes are picked early, a wine has a tendency toward excess tannins and acidity with deficiencies in polysaccharides, sugar, and ethanol. As the fruit becomes more mature, the composition becomes more balanced and the descriptors become more positive. A winemaker has the ability to modulate wine descriptors by adjusting the balance accordingly. As depicted, Figure V is in line with research on tannins and perception.

From the research gathered to date, including the biosynthesis of tannins and the overall development of the berry, the picture that is emerging is that tannin changes in the grape do occur, and the relative amounts of tannins in the skin and seed vary depending on grape production practice. Moreover, the changes that occur during berry maturation that do not involve tannins produce changes that positively influence the quality of tannins.²⁵

Conclusions

Tannins are mainly in the skin and seeds of grape berries.

- Grape seeds and skins contain different types of tannin.
- There are two important phases: tannin accumulation and tannin maturation.
- In skins, tannin accumulation starts around flowering and is completed before veraison.
- In seeds, tannin accumulation starts around flowering and is completed one to two weeks after veraison.
- Tannin maturation occurs during ripening and results in progressively decreased extractability of tannins, coinciding with perceived softening and ripening of tannins.
- Skin and seed tannin extraction during maceration can be manipulated during fermentation.
- Tannin perception is complex and depends not only on tannin composition, but on the composition of the wine in which the tannin is present.

If we are to effectively and reproducibly manage astringency and quality in red wine a systematic understanding of all aspects of these extraordinarily complex compounds will be required. ■

Acknowledgments

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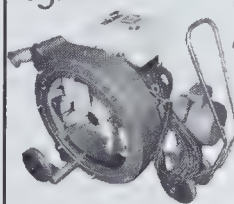
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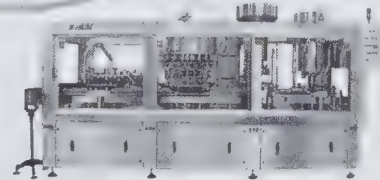
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Strategies to improve **MERLOT** productivity

BY Susan van Goor,
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Sonoma State University,
Rohnert Park, CA
George Buonaccorsi,
Beringer Fosters Wine Estates
Napa, CA
Chris Kjeldsen,
Sonoma State University

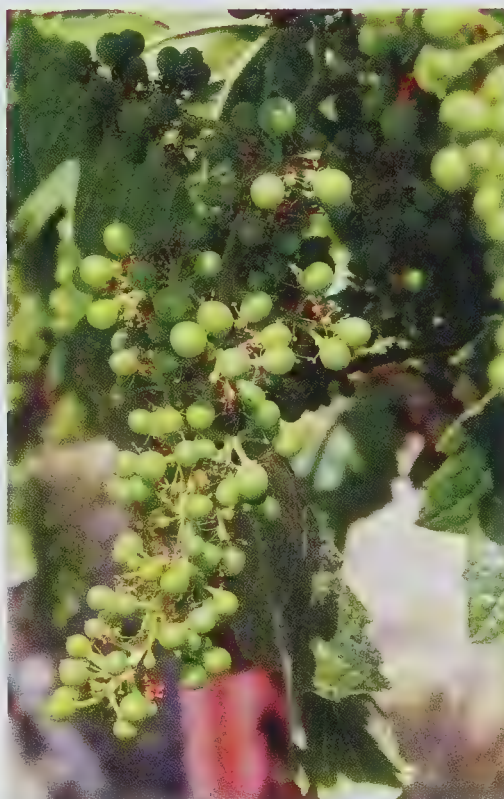
Many Merlot vineyards in cool coastal climates experience detachment of berries from the cluster after fruit set, either with or without the pedicel, that is known as "shatter." Some growers describe poor fruit set as "shatter."

In 2003 and 2004, many Merlot vineyards experienced severe shatter problems, including the vineyard used for this study, which is located near Napa, CA. San Francisco Bay, approximately 14 miles to the south, keeps the area fairly cool. Although these weather conditions enable a longer growing season, they can also contribute to poor fruit set.

In 2005, 31,675 tons of Merlot were crushed in Napa Valley (see Appendix I), with a value of just over \$83 million. In a poor fruit-set year, there would be great economic and possible quality benefits to growers and wineries if the effects of Merlot shatter could be minimized. Even a 10% increase in yield would save millions of dollars.

This study shows that treatment with molybdenum can lead to a 20% increase in yield, and that no shoot-thinning can lead to a 50% increase in yield, both with only a small decrease in sugar content.

The primary purpose of this trial was to explore methods to improve yield in



Normal fruit set just past the shatter stage. Considerable brown flower debris is still present.

Merlot. In 2003 and 2004, Merlot yield was low in this vineyard, ranging from 1.0 to 3.0 tons per acre in 2003, and from 2.0 to 3.1 tons per acre in 2004. As with many vineyards, there were large yield variations within vineyard blocks. Low-lying areas generally had higher yields in both years. Those higher yields may have been the result of better fruit set due to differences in factors such as water availability, nutritional status, vine vigor, or general vine health.

To test some of these parameters, several trials were conducted in the 2005 growing season to determine if

pruning practices, canopy management, or molybdenum applications could increase Merlot yields at that site.

A complete randomized block design was used in all of the trials with four plots (rows) per treatment. In the pruning trial, there were 186 vines in each row and 19 data vines per plot. The canopy management trial had 151 to 156 vines per row with 15 data vines per plot. The molybdenum trial had 69 to 72 vines per row and 14 data vines in each plot.

All vine rows in this study, were spaced eight feet apart, with six feet between vines. The vines were trained to a VSP trellis. With the exception of the treatments, all vines were given the same care as the rest of the block throughout the season.

Irrigation water was supplied by drip irrigation when vine symptoms indicated water stress (such as leaf angle, shoot tips, internode length, and tendrils). As 2005 was a relatively cool growing season with rains late in the spring, irrigation was not started until early August in the trial blocks.

Pruning trial

Pruning experiments were conducted in a block planted in 1998 to Merlot clone 3 on 5C rootstock. This block has traditionally had heavy



A cluster exhibiting extreme shatter.

Table I. Average yield components and Brix levels of the pruning trial.

Treatment	Buds/ Vine	Shoots/ Vine	Clusters/ Vine	Clusters/ Shoot	100		Yield		Brix 9/23/05
					Berry Wt* (g)	Cluster Wt (g)	Berries/ Cluster	(kg/ vine)	
Cane-pruned	24	22.8a	38.0a	1.68a	142.3a	165.8a	116.1a	6.2a	23.6
Two-bud spur	24	22.5a	35.4b	1.57b	147.0ab	174.4abc	118.4a	6.3a	23.8
Three-bud spur	24	21.2b	33.0c	1.56b	147.8b	192.7c	131.5bc	6.5ab	23.8
Cane-pruned	40	33.8c	57.0d	1.69a	135.6c	169.3ab	123.3ab	9.6c	22.9
Two-bud spur	40	35.2d	56.8d	1.61bc	129.1d	165.5a	127.2abc	9.4c	21.8
Three-bud spur	40	29.2e	48.3e	1.65ac	133.2cd	185.8bc	138.5c	9.1bc	22.1

Note: Means followed by the same letter are not significantly different according to Duncan's Multiple Range test, $p \leq 0.05$.

* Berry weights are of a 100-berry sample.

Brix levels were not tested for significant differences.

foliage with low yield in poor fruit-set years. Treatments compared two-bud spur, three-bud spur, and cane pruning with either 24 or 40 buds per vine. Vines were pruned in February 2005, and later thinned to the number of shoots that corresponded with the bud count planned. Yield components (including clusters per shoot, berries per cluster, and yield per vine) were calculated from shoot and cluster counts, and berry and cluster weights (Table I). Brix measurements were taken on September 23, 2005.

The number of buds left at pruning had significant impact on yields, while the style of pruning did not. The yields of the 40-bud treatments were 50% higher than those with 24 buds. Treatments with 40 buds, however, had lower sugar levels late in the harvest season. Sugar samples in late September averaged 22.3° Brix for vines pruned to 40 buds, while vines pruned to 24 buds had sugars averaging 23.7° Brix.

This loss of 1.4° Brix indicates that 40 buds may have been too heavy a crop load in the block in 2005, which was a good fruit set year. On the other hand, pruning to only 24 buds has produced low yields (under 3 tons per acre) in poor fruit set years. Previous research has found that an increase to 30 buds at pruning offered the most significant increase in yield.¹⁰

Of the pruning styles used, the three-bud spur-pruned vines had the lowest percentage budbreak and fewest clusters per vine, but they had

the highest cluster weights and number of berries per cluster (Table I).

As a recommendation for further study, this trial should be extended over multiple years to determine if either the pruning style or bud count has a detrimental effect on vine health or yield over the long term.

Canopy Management trial

The canopy management trial was conducted in a block planted in 1997 to Merlot clone 3 on 3309C rootstock. Canopy management styles compared were: no shoot-thinning (crown- and trunk-suckering only), and shoot-thinning to two shoots per spur (either in the early spring or at 50% bloom).

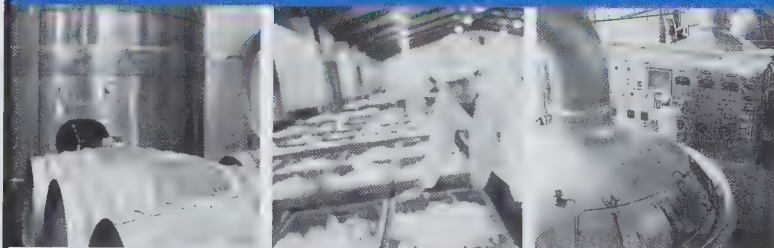
The early spring treatment was conducted at the modified E-L Stage (MELS 13), defined as six leaves separated.⁶ The other shoot-thinning treatment was done at 50% capfall or MELS 23. Vines were pruned to 10 to 14 two-bud spur positions. Yield components are shown in Table II. Brix levels for the canopy management trial were measured on August 24, 2005.

In the canopy management trial, the vines not shoot-thinned had the highest calculated yield, over three kilograms per vine more than either shoot-thinned treatments — an increase of



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Table II. Average yield components and Brix levels of the canopy management trial.

Treatment	Shoots/ Vine	Clusters/ Vine	Clusters/ Shoot	Berry Wt* (g)	Cluster Wt (g)	Berries/ Cluster	Yield (kg/vine)	Brix 8/24/05
No shoot thinning – suckering only	30.9a	50.5a	1.67a	138.0a	177.4a	130.7a	8.9a	19.1
Shoot thin at MELS stage 13	20.8b	35.8b	1.72ab	140.2a	154.6b	110.3b	5.6b	19.7
Shoot thin at MELS stage 23	19.7b	34.4b	1.75b	137.0a	169.0ab	123.4a	5.8b	19.5

Note: Means followed by the same letter are not significantly different according to Duncan's Multiple Range test, $p \leq 0.05$.

*Berry weights are of a 100-berry sample.

Brix levels were taken on August 24, 2005 and were not tested for significant differences.

over 50%. This yield increase was primarily attributed to the increase in clusters per vine and to increased cluster weight (Table II).

The additional yield, however, did result in sugar levels that averaged 0.5° Brix lower in vines that were not shoot-thinned. The increase in yield was likely due to a higher leaf-to-fruit ratio during bloom and fruit set.

Prior research has shown that leaf removal at bloom, or up to two to three weeks past bloom, decreases berry set, berry weight, cluster weight, and ultimately yield.^{3,4,5}

Vines that were shoot-thinned at bloom had more berries per cluster than vines shoot-thinned before bloom

(Table II). This was likely due to an increase in fruit set caused by removal of shoot tips during flowering.

This coincides with earlier research showing that removal of shoot tips at bloom (either directly on main shoots or by removing lateral shoots) increases fruit set, and subsequently the number of berries per cluster, the cluster weight, and the yield.^{5,11} The theory is that removal of shoot tips decreases competition for carbohydrates between shoot tips and clusters.

Prior studies have shown that removing shoot tips one week before bloom or after bloom, however, did not affect fruit set.^{1,5} Implications of this

trial suggest that, in years of poor fruit set, it is best to not shoot-thin, or to wait until bloom to shoot-thin. One drawback, however, is that the later shoot-thinning is done, the more expensive it will be to perform the task and the greater the difficulty and danger of damaging other shoots. Also, suckering alone, and not shoot-thinning, tends to increase pruning costs in the following year.

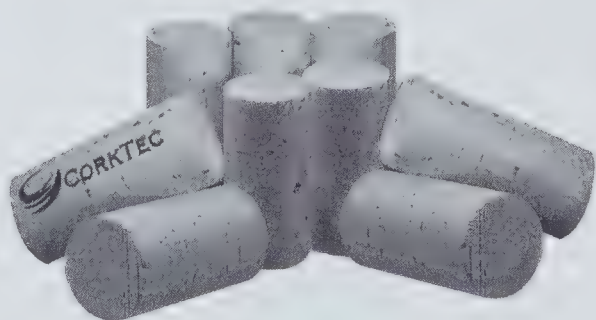
In future research, it would be interesting to calculate the costs of each treatment. The pruning costs incurred following the growing season should be calculated to determine whether they outweigh the benefits.

Molybdenum trial

The molybdenum application trial was conducted in a block planted in 1998 to Merlot clone 3 on 3309C rootstock. Treatments included a control, which was not sprayed with molybdenum, and a treatment with two foliar applications of sodium molybdate ($\text{Na}_2\text{MoO}_4 \cdot 2\text{H}_2\text{O}$) at a rate of 0.1 g per vine each application.

Molybdenum applications were made at MELS 13 (six leaves separated) and MELS 20 (10% capfall), on April 16, 2005 and May 16, 2005 respectively.^{6,8} Yield component results are shown in Table III. Brix levels for the

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Table III. Average yield components and Brix levels of molybdenum spray trial.

Treatment	Shoots/ Vine	Clusters/ Vine	Berry Wt* (g)	Cluster Wt (g)	Berries/ Cluster	Yield (kg/vine)	Brix 8/20/05
No molybdenum spray	20.5a	33.8a	140.9a	129.1b	92.0b	4.4b	20.2
0.1g Mo/vine ea. Applic. stage MELS 13 & 20	20.8a	33.6a	145.3a	157.4a	108.5a	5.3a	19.5

Note: Means followed by the same letter are not significantly different according to Duncan's Multiple Range test, $p \leq 0.05$. * Berry weights are of a 100-berry sample.

Brix levels were taken on August 20, 2005 and were not tested for significant differences.

molybdenum trial were measured on August 20, 2005.

Molybdenum application significantly increased cluster weights and berries per cluster. Yields increased by 20% with the application of molybdenum. The Brix levels in the treated group were an average of 0.7° Brix below those of the lower-yielding, untreated group.

Other researchers have found that yields were not improved by molybdenum application unless the vines were already deficient in molybdenum.⁸ Molybdenum deficiency has been linked to excessive nitrogen levels in petioles.⁹

While petiole samples were not taken prior to application in this experiment, data from the previous year show low levels of nitrate-nitrogen in the

block used for this experiment. This may imply that the vines in this trial were not deficient in molybdenum.

In future studies, it is recommended that petiole samples be taken before treatment applications in order to determine existing molybdenum and nitrogen levels before molybdenum applications are made.

Conclusions

While the results of this study are limited to a single year and a single vineyard location, several conclusions might be drawn from the findings of this trial in combination with a literature review. In the pruning trial, vines pruned to 24 buds had yields greater than six tons/acre in 2005, but may have inadequate crop levels in high shatter years.

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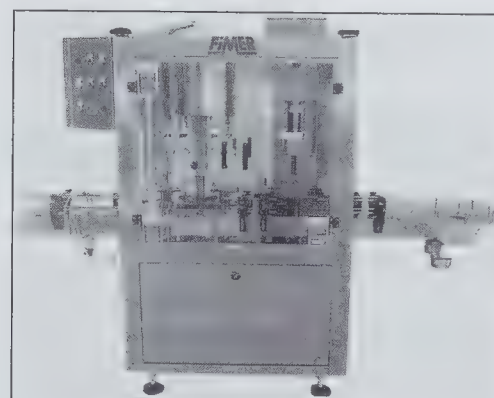


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Appendix 1. Napa (District 4) Wine Grape Statistics

Data developed from CDFA, Final Grape Crush Reports, 1995 to 2005 and CDFA, California Grape Acreage Reports, 1995 to 2005.

Year	Tons Crushed	Bearing Acres	Yield per Acre	Price per Ton
2005	31,675	7,211	4.4	\$2,661
2004	22,270	7,231	3.1	\$2,591
2003	21,184	7,027	3.0	\$2,685
2002	28,161	6,798	4.1	\$2,790
2001	23,728	6,624	3.6	\$2,732
2000	27,737	6,024	4.6	\$2,488
1999	21,678	5,312	4.1	\$2,292
1998	16,931	4,550	3.7	\$2,075
1997	22,584	4,014	5.6	\$1,944
1996	12,524	3,415	3.7	\$1,783
1995	11,637	3,159	3.7	\$1,602

On the other hand, vines pruned to 40 buds had high crop levels (greater

than nine tons/acre) in 2005, which resulted in low sugar levels. Other studies have found that increasing the number of buds left at pruning to 30 buds in vigorous blocks may help balance the vigor and increase yield, without sacrificing quality.

Results of the canopy management trial showed a more than 50% increase in yields from vines that were crown- and trunk-suckered only, compared to vines shoot-thinned to two shoots per spur. This is likely a result of a higher leaf-to-fruit ratio during bloom and fruit set.

Vines shoot-thinned in early spring had significantly fewer berries per cluster compared to other treatments. The vines shoot-thinned at 50% bloom (MELS 23) did not result in a significant decrease in berries per cluster. This may be a result of the removal of active shoot tips at bloom that compete for carbohydrates with inflorescences.

In the molybdenum application trial, an application of molybdenum at both MELS stages 13 and 20 resulted in a 20% increase in yield compared to vines not treated with molybdenum. Treated replicates had an average decrease of 0.7° Brix in late August, likely due to the increase in yield. Molybdenum and nitrate-nitrogen levels of the vines should be checked, and applications made before bloom the following season if molybdenum is found to be deficient.

The primary purpose of this study was to investigate methods to improve fruit set in Merlot vineyards and improve yield. There are several interesting paths for future researchers to pursue.

First, a multi-year study would help to demonstrate long-term effects in subsequent years. This could also include cost measure-

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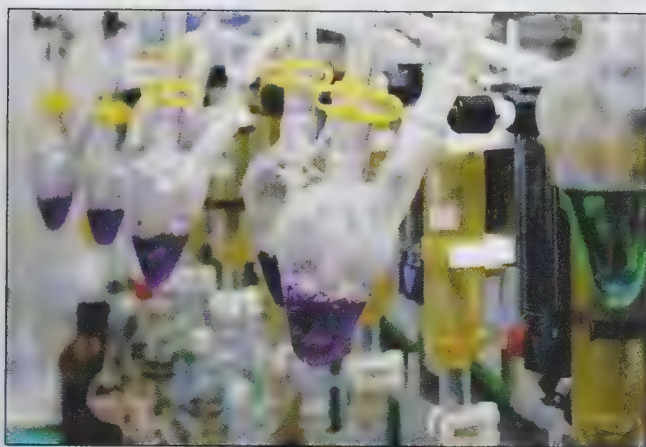
ments to determine if benefits exceed the costs.

Second, measuring vine vigor, through pruning weights or leaf area measurements, is important as a reference and would help in determining if the same technique would be appropriate in a low vigor vineyard. Third, wine quality could be measured by using wine descriptors at harvest and measuring additional chemical components in order to establish whether the increased yield came at the cost of wine quality.

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WINEMAKING

Wine Tannins

Continued from page 67

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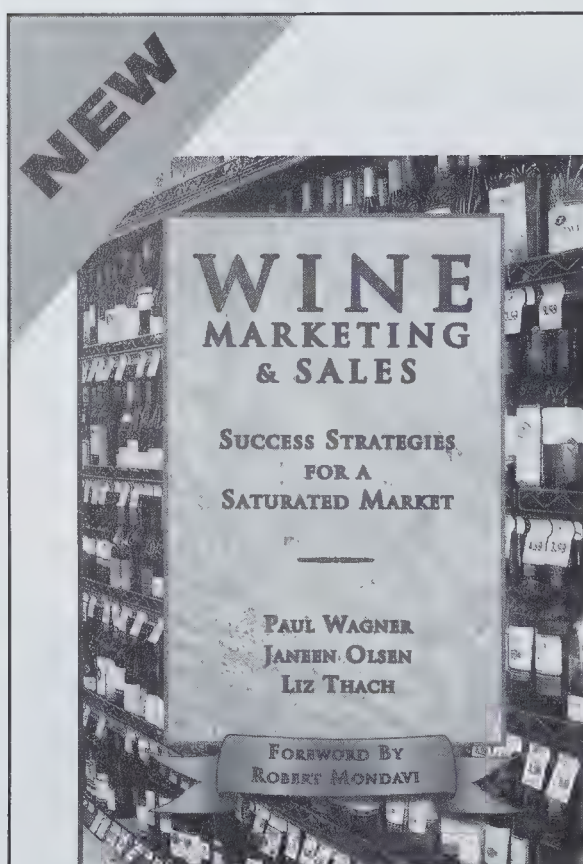
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Barrels supplied by Nadalie have traditional open-fire toasting. In America, Nadalie started the fire-toasting process in 1980. Barrels manufactured in Calistoga and Bordeaux are toasted the old, traditional French way. To focus on the fruity and spicy character of French oak, the Bordeaux cooperage has developed the Perle Blanche toasting process primarily for white wines.



All Oak Add-Ins are also toasted over open-oak fires. Wines fermented with Oak Add-Ins are unique in the industry. Over the past year, manufacturing of Oak Add-Ins has been refined to focus on two major toasts medium and medium-plus. More toasting levels are available for chips, cubes, and blocks. Nadalie manufactures a complete line of Oak Add-Ins which respects traditional winemaking techniques.

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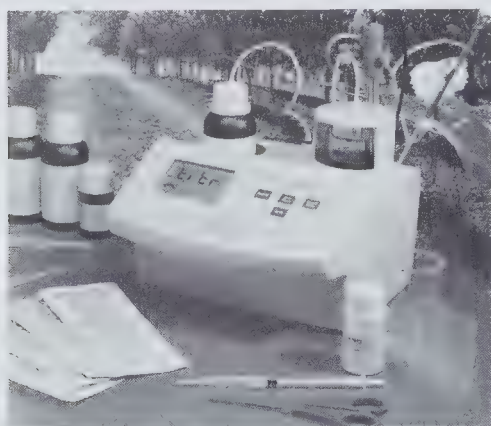
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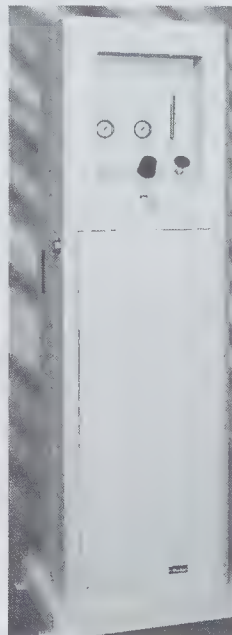
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- Improved wine clarity in bottle;
- Enhanced aroma and flavor in red wines — preserving more of the highly-desirable fresh, fruity character;
- Reduction in excessive astringency or color when needed.

Polyclar® V is a preferred option for use in wine due to its large surface area, which permits maximum efficacy. It is usually added to wine after initial clarification, during or after tartaric stabilization, or before pre-bottling filtration.

Polyclar® VT is a coarser grade of PVPP, optimized for addition to wine in tanks. The large particle size facilitates settling of the stabilizer, allowing the majority of the product to be left behind with the lees at racking.

For more information, contact:

International Specialty Products
Mustafa Rehmanji
1361 Alps Road, Wayne, NJ 07470
tel: 973/872-4403; fax: 973/628-3886
e-mail: info@ispcorp.com
website: www.ispcorp.com

KOCH MEMBRANE SYSTEMS, INC.

New from Koch Membrane Systems, Inc. (KMS) is the model WF-6 hollow fiber crossflow microfiltration (CMF) system designed specifically for use in wine clarification. This six-cartridge system employs a new membrane that is sturdier and more productive than other membranes, and will process wine at up to 57 hl/hr.



With KMS crossflow filtration, a feed stream flows parallel to the membrane surface at high velocity, as compared to the perpendicular flow path employed in conventional depth filtration. By keeping suspended material from settling, crossflow filtration minimizes the build-up of solids on the membrane, delivering a high permeation rate and maintaining stable throughput. CMF can be employed as a one-step process, eliminating the need for multiple diatomaceous earth filtration steps.

KMS systems are flexible, efficient, and gentle on wine due to minimal oxygen pickup and heating. The WF-6 is available as a manually-operated machine, or a fully-automated system requiring little or no operator attention.

For more information, contact:

Koch Membrane Systems, Inc.

850 Main St., Wilmington, MA 01887

tel: 888/677-5624

e-mail: info@kochmembrane.com

website: www.kochmembrane.com/wine2

PLEASE SEE KOCH MEMBRANE AD, PAGE 95.

MAURIVIN YEAST

Research undertaken by the University of Western Sydney (Australia), investigated the impact of fermenting Australian Syrah with different red-winemaking strains. Syrah fermented by Maurivin's red-winemaking strain AWRI 796 resulted in wines with higher fruit aromas such as blackberry and plum. In contrast, Syrah fermented with Maurivin's BP-725, displayed strong black pepper and spicy compounds.

The chosen yeast strain does play an important role in determining the aroma and flavor of Syrah. AWRI 796, ideal for fruit-driven red wines, has a strong fermentation capacity, high alcohol tolerance, higher glycerol levels, and yields a lower ethanol level. BP 725, a strain ideal for enhancing peppery and spicy characters, may increase color extraction and minimize color loss during fermentation.

maurivin™

The latest hybrid yeast from the Australian Wine Research Institute, Maurivin's AWRI 1503, is growing in popularity with red winemakers. AWRI 1503 was developed by mating the efficient, reliable Maurivin PDM with a strain of *Saccharomyces kudriavzevii* that enhances palate weight and complexity. Commercial red-winemaking trials show this hybrid strain to increase palate length and fruit concentration while retaining strong fermentation properties and high alcohol tolerance of PDM.

Along with these new innovative products and research, Maurivin continues to deliver premium, high-performance fermentation aids, such as the ever-popular Mauriferm Gold.

For more information, contact:

Maurivin/Mauriferm

c/o Pacific Coast Chemicals

2424 Fourth St., Berkeley, CA 94710

tel: 510/549-3535; fax: 510/549-0890

e-mail: steveshaffer@pcchem.com

website: www.pcchem.com, OR

www.maurivin.com

PLEASE SEE MAURIVIN YEAST AD, PAGE 32.

OAK SOLUTIONS GROUP

ēvOAK by Oak Solutions Group continues its attention to winemaker needs and commitment to creative technology. New products include:

Pure² are robust vanilla tank staves. The name refers to concentrated flavor and aroma. The second generation Pure² is intense vanilla and low tannin. High Vanilla Pure² is the latest addition to the company High Extract tank stave series that includes High Mocha, High Toast, High Spice, and High Vanilla.

Cuvee means a blend. Using expertise and research in the field of oak, ēvOAK has developed two new tank staves for its Cuvee Series. Each Cuvee or blend is formulated with certain flavor characteristics in mind to help winemakers craft wines that are truly unique.



Cuvee N° 1 is a tank stave with unmistakable macaroon flavor. N° 1 has qualities of toasted coconut, phyllo dough aromas, almond biscotti, toasted almonds and hazelnut with a taste of honeysuckle. It is appealing for white wines.

Cuvee N° 2 provides impressions of toasted marshmallow, vanilla crème, classic crème brûlée, and nougat. N° 2 is little more full-bodied than N° 1, adding more creamy intensity to both reds and whites.

These new releases can be tasted bench trial sample kits are available.

For more information, contact:

Oak Solutions Group

Paul Abbott, Oak Solutions Specialist

2557-D Napa Valley Corp. Dr.

Napa, CA 94558

tel: 707/259-5988; fax: 707/255-5952

e-mail: pabbott@oaksolutionsgroup.com

website: www.oaksolutionsgroup.com

PLEASE SEE OAK SOLUTIONS GROUP AD, PAGE 59.

CUNO FILTER SYSTEMS

CUNO is a world leader in the design and manufacturing of a comprehensive line of filtration products and systems for clarification and final filtration of fine wines.

Innovative CUNO products for wine filtration include the first non-asbestos filter sheet (Zeta Plus®), the first multi-zoned membrane prefilter (LifeASSURE®), and the first dual-zone clarification filter cartridge (Zeta Plus Maximizer™).



CUNO has added to this impressive list the BevASSURE® PES line of final membrane filters. BevASSURE PES, a new, polyethersulfone membrane final filter, combines three new technologies from CUNO to improve filter throughput and reduce operating costs. A highly asymmetric microporous membrane, a patented pleating design, and a novel, patent-pending support layer construction, work in concert to deliver ultra-fast flow rates, secure spoilage organism retention, and remarkable throughput.

With over 90 years of experience and manufacturing facilities on five continents, CUNO is uniquely suited to provide solutions to wineries worldwide.

For more information, contact:

CUNO Incorporated, a 3M company
400 Research Parkway, Meriden, CT 06450
tel: 800/243-6894; fax 203/630-4530
e-mail: cjohara@cuno.com
website: www.cuno.com

RANDOX LABORATORIES USA

Randox Laboratories introduces the RX monza™, a compact, economical semi-automatic analyzer designed for winery laboratories. The RX monza™ is an easy to use analyzer for rapid analysis of wine and grape samples that comes complete with integral screen, keyboard, and printer. All tests are stored on-board and selected using labeled one-touch buttons. RX monza™, designed for straightforward operation, is robust, reliable, and requires little maintenance.



RX monza™ offers wineries a faster, more convenient means of analyzing samples compared to manual methods using spectrophotometers. Calibrations are stored on-board and calculations are carried out automatically by the analyzer giving results in requested units. The RX monza™ has a large LCD screen, user-friendly software, and a dedicated help bar to enable an operator to complete the analysis process quickly and easily.

Randox has 25 years' experience in research, development, and manufacture of a wide range of high-quality test kits. The kits include: TAS (total antioxidant status), malic acid, lactic acid, acetic acid, glucose/fructose, ammonia, and potassium.

The RX monza™ and Randox test kits offer wineries a modern innovative analyzer and high-quality test kits for a complete analysis package.

For more information, contact:

Randox Laboratories USA
4065 Oceanside Blvd., Ste. Q
Oceanside, CA 92056-5824
tel: 866/472-6369; fax: 866/726-3691
e-mail: randoxus@randox.com
website: www.randox.com

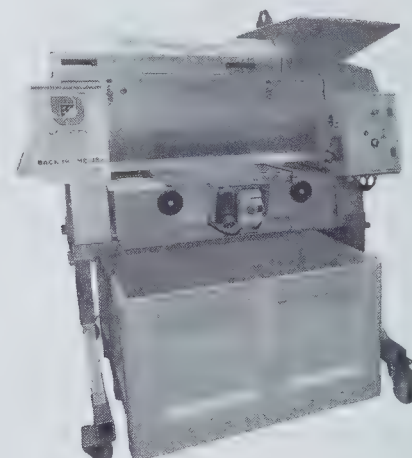
PLEASE SEE RANDOX LABS AD, PAGE 67.

NAPA FERMENTATION SUPPLIES

Napa Fermentation has an extensive array of winemaking supplies including:

- Winemaking kits and ingredients;
- Wine yeast, nutrients, and Malolactic cultures;
- Chemicals;
- Stoppers, bungs, and spigots;
- Camlocks;
- Wine test equipment;
- Buckets and fermentors.

Lalvin fermentation supplies are carried including: 23 strains of wine yeast and enzyme products, Malolactic bacteria Chr. Hansen Viniflora Oenos, Chr. Hansen CH 16, and Chr. Hansen CH35, and yeast nutrients Fermaid K and Super Food.



Also available is a full line of Zambelli winemaking equipment including crushers (up to 14 tons per hour), membrane presses (up to .45 HL), electric hydraulic presses, bladder presses, bottle fillers, auto corks, pressure-sensitive labelers, plate filters, cooling units, pumps for must and wine.

Napa Fermentation carries the accurate, reliable, and easy-to-clean French Demoisy Galeo Destemmer, and Demoisy grape sorting, vibrating tables, and vibrating separators. Stainless steel fittings and Karcher hot and cold pressure washers are also available.

For more information, contact:

Napa Fermentation Supplies
575 Third St., Bldg. A (Inside the Napa Town & Country Fairgrounds)
PO Box 5839, Napa, CA 94581
tel: 707/255-6372; fax: 707/255-6462
e-mail: wineyes@aol.com
website: www.napafermentation.com

PLEASE SEE NAPA FERMENTATION AD, PAGE 51.

G3 ENTERPRISES

After four years of research, G3 Enterprises and FILTROX are proud to unveil TRIEX, an effective new way to remove TCA taint from wine and other beverages. TRIEX is a patent-pending compound that removes TCA without damaging a wine's aroma or flavor.



TCA (trichloroanisole) is a serious problem for the wine industry, estimated to cost winemakers more than \$200 million annually. TCA can be found in corks, oak barrels, storage tanks, and other winemaking equipment. Its moldy odor can be detected in wine at levels as low as 5 parts per trillion. Even at lower levels, it can affect a wine's taste and bouquet.

TRIEX is an inorganic compound that has already received regulatory approval for treating wine, and has been specifically engineered to remove TCA molecules.

TRIEX is also extremely effective in removing tribromoanisole (TBA) taint. TBA is a chemical contaminant similar to TCA and has a similar impact on wine. TRIEX has already been used to remove TBA taint from several thousands of gallons of client wine. Filtering tainted wine through filter sheets containing TRIEX is more effective than earlier methods and doesn't change the wine flavor.

For more information, contact:

G3 Enterprises

Customer Service

502 E. Whitmore Ave., Modesto, CA 95358

tel: 800/321-8747

e-mail: g3customer.service@g-3enterprises.com

website: www.g-3enterprises.com

BENTONITE PERFORMANCE MINERALS LLC

BPM's mission statement is: develop, market, manufacture, and support the finest bentonite products in the world. BPM products are leaders in a range of industrial, specialty, consumer, and environmental markets worldwide. BPM was the first Wyoming bentonite producer to achieve ISO registration at all manufacturing locations. BPM is licensed to use the API monogram labeling on its API bentonite products.

Fining Agent:



VITIBEN® fining agent is made of the purest bentonite and produces superior clarity and heat stability that fine wines deserve. VITIBEN is designed to "fine" or remove undesirable compounds from wine and juices. These compounds include phenolics, proteins, and tannins, which are present in the fruit or result from natural enzyme reaction during processing and aging.

Benefits:

1. Superior dispersibility;
2. Easy handling;
3. Higher yields;
4. Higher activity;
5. Longer equipment life.

VITIBEN fining agent is listed by the Food and Drug Administration (FDA) as Generally Recognized As Safe (GRAS). VITIBEN is certified as Kosher by the Scroll K. Purchase VITIBEN directly from one of Bentonite Performance Minerals LLC agents: Brenntag Pacific, Inc., 559/268-4571, Gusmer Enterprises, 559/485-2692, or Pacific Coast Chemical, 510/549-3535.

For more information, contact:

Bentonite Performance Minerals LLC

3000 N. Sam Houston Pkwy. E

Houston, TX 77032

tel: 281/871-7900; fax: 281/871-7940

website: www.bentonite.com

PLEASE SEE BPM AD, PAGE 12.

KLR MACHINES

KLR Machines is a distribution partner for E. Begerow GmbH & Co., the German high-quality manufacturer of depth filter media and filtration equipment.

BEGEROW

The BECO depth filter sheet product range has the least amount of ion migration coupled with the highest retention of particulate matter of any filter sheet in the wine industry. Sheet grades for wine range from K-1 at nominal 4.5 micron retention to Steril 40 through Steril 100 at nominal 0.1 micron retention.

KLR Machines has Becofloc 7 and 10 and SIHA Isinglass, in stock.

Begerow customer's end products are subject to very rigorous and precisely defined quality requirements. "As part of the overall manufacturing process, depth filtration has to safely produce reproducible and therefore economic results," says Begerow owner Christa Tesch. Begerow is geared towards producing and offering products and services of persistently outstanding quality.

For more information, contact:

KLR Machines

350 E. Morris St., Sebastopol, CA 95472

tel: 707/823-2883

website: klrmachines.com

PLEASE SEE KLR MACHINES AD, PAGE 15.

PACIFIC WINEMAKING

Pacific Winemaking was established to link quality suppliers of innovative winemaking products with premium winemakers to enhance quality, efficiency, and returns.

Pacific Winemaking represents Bucher Vaslin equipment for crushing and winemaking. Products include grape reception, conveying, selection, destemming, pumping, and pressing.

Pacific Winemaking also represents the Vason Group, whose extensive R&D facility and years of experience in the European wine market integrates both applied biotechnology with innovative engineering. Vason is composed of winemakers who are interested in solving winemaking problems. They are made up of:

E N O L O G I C A
VASON
V A S O N

Enologica Vason supplier of quality yeasts, nutrients, malolactic bacteria, high purity enzymes, fining agents, and tannins. Products are quality control tested, and complement integration with their innovative winemaking equipment.

B E V E R A G E S Y S T E M
JUCLAS
V A S O N

Ju.Cla.S. Beverage Systems manufacturer of engineered solutions. Ju.Cla.S. products include precise micro-oxygenation, micro-filtration, spiral wound membrane cross flow technology, filterability testing, automated yeast hydration, flotation systems, electrodialysis tartrate stabilization, and reverse osmosis.

For more information, contact:

Pacific Winemaking

Bruce A. Felix

PO Box 731, Carlton, OR 97111

tel: 503/419-7942; fax: 510/764-9713

e-mail: info@pacificwinemaking.com

website: www.pacificwinemaking.com

LAFFORT OENOLOGIE

Laffort Oenologie is the worldwide manufacturer of a complete range of enological products, including yeast, bacteria, nutrients, tannins, enzymes, fining agents, and stabilizing agents.

Laffort BIOLEES product is revolutionary. This polypeptide is the purified active agent in lees aging, producing a double effect of sweetening and giving roundness to a wine, while also producing a fining effect. It is useful for both red and white wines.



LAFFORT

l'œnologie par nature

New from Laffort Oenologie for 2007:

Lactoenos 450 PreAc is a new concept that combines a strain of *Cenococcus oeni* specially selected for its remarkable resistance to difficult wine conditions (SO₂, pH, alcohol, and temperature) and high malolactic activity including a special activator. Thanks to its cost/efficiency ratio, 450 PreAc is perfect when results and costs matter.

A new Zymaflore X-16 yeast strain is specific for tank-fermented Chardonnay. Even under difficult fermenting conditions (low turbidity, low temperature), X-16 shows strong fermentative capabilities, fast kinetics, high alcohol tolerance (16%v/v), and low VA. This strain produces excellent fermentation aromas (esters) and makes very aromatic, complex (fruity, floral) wines and with an intense mouthfeel.

Laffort Research has demonstrated a novel application for its well-known Tanin VR Supra. This fermentation tannin is capable of precipitating proteins and thus protects the grape's natural skin tannins.

For more information, contact:

Laffort Oenologie

Russell Robbins

405 St. Andrews Dr., Napa, CA 94558

tel: 707/815-0225; fax: 707/251-5593

e-mail: russell.robbs@laffort.com

website: www.laffort.com

STAVIN INCORPORATED

StaVin oak is naturally seasoned for three years and available in three toast levels. To ensure thorough heat penetration and complex flavors, the oak is traditionally fire-toasted.



Three-year seasoned, traditionally fire-toasted staves.

StaVin also offers Savour Oak convection-toasted products. After extensive research, the company has optimized flavors via an oven, through a proprietary time and temperature protocol.

StaVin's website, micro-ox.com, discusses how the company's oak and micro-oxygenation replicate the benefits of winemaking in barrels — in tanks. Read how StaVin's oak effectively cross-links grape tannins to build mid-palate structure and stabilize color in red wine fermentation.

Reduce your dependency on barrels for flavoring and aging. StaVin's Tank Fan Packs deliver the same traditional flavors as your favorite barrels in tanks.

StaVin's Oak Beans and stave Segments are versatile and cost-effective systems, packaged in food-grade nylon bags, for imparting barrel flavors in tanks.

Impart neutral barrels with the complexity and quality of new oak barrels with StaVin's Oak Barrel Replica, Barrel Insert (now available in a new barrel extraction level) or Infusion Tube.

For more information, contact:

StaVin Incorporated

Alan Sullivan, Steve Sullivan, Dr. Jeff

McCord, Dr. Jeff Murrell, Jamie Zank

PO Box 1693, Sausalito, CA 94966

tel: 415/331-7849; fax: 415/331-0516

e-mail: info@stavin.com

website: www.stavin.com

PLEASE SEE STAVIN AD, PAGE 40.

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Dept. of Primary Industries & Resources,
South Australia

106pp—\$40.00

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Peter May

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Gregg Young

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A manual for winemaking with screwcaps
Tyson Stelzer

Detailed technical discussion of screwcaps and the bottle, reasons for choosing screwcaps, winemaking procedures, chemistry, bottling, capping, handling, storage, and ageing.

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David Storm

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J. Chapman, P. Baker, & S. Wills

Examines the chemical nature of wastewater, its impacts, how it can be handled efficiently, and disposed of responsibly.

128pp—\$25.00

LALLEMAND

Lallemand offers over 100 specific oenological yeasts, selected from nature in response to the technical and stylistic goals of winemakers worldwide. This careful selection process allows the yeast to enhance and reveal the quality naturally present in grapes. In North America, Lallemand offers over 50 of the more successful yeasts to meet creative needs while working within growing and winemaking practices.

**SPECIALTY YEAST**

Two new specialty yeasts include:

- **CROSS EVOLUTION™** yeast that enhances floral and fruity aromas with balanced mouthfeel in whites;
- **LALVIN® RHTNE 4600** yeast that enhances volume and aromatic elegance in whites.

For help choosing yeasts to fit your grapes, fermentation conditions, and stylistic goals, please visit Lallemand website, with brief descriptions providing general information on each yeast and what sets it apart from others under winemaking conditions. In addition, use the Yeast Chart and the Grape and Yeast Pairing Guide, to help you select complimentary yeasts.

For more information, contact:

Lallemand

Gordon Specht or Sigrid Gertsen-Briand

PO Box 5512, Petaluma, CA 94955

tel: 707/526-9809 or 707/303-6333

e-mail: gspecht@lallemand.com or

sigrid@lallemand.com

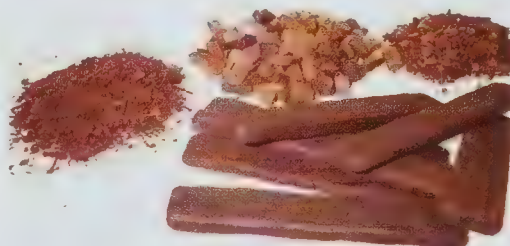
website: www.lallemandwine.us

PLEASE SEE LALLEMAND AD, PAGE 6.

PICKERING WINERY SUPPLY

Pickering Winery Supply (PWS) distributes oak adjuncts from Suber-Lefort of Adelaide, Australia, which has 16 years' experience in turning French barrel-quality oak into tank planks, mini-staves, chips, flakes, and powder. It is the seasoning and toasting regimens of the oak that result in flavor profiles quite distinct from any others.

Suber-Lefort works with many wineries to develop specialized flavor profiles to match the style of wine they wish to produce. Yellowtail, the most popular Australian brand in America, buys almost exclusively from Suber-Lefort.



PWS distributes a special fining agent produced in Germany, Vinpur Special, based on casein. It offers a gentle way to remove astringency, brown pigments, and oxidized phenols in red and white wines. What makes it unique is that it uses cellulose as a carrier, giving the casein a larger surface area and making it disperse much more completely. The result is a powder that can be directly added to wine and is very predictable, unlike regular casein.

Many wineries now consider Vinpur Special an integral part of their winemaking.

For more information, contact:

Pickering Winery Supply

888 Post St., San Francisco, CA 94109

tel: 415/474-1588; fax: 415/474-1617

e-mail: info@winerystuff.com

website: www.winerystuff.com

PLEASE SEE PICKERING AD, PAGE 55.

ATAGO USA, INC.

For quality wines, use a quality refractometer. ATAGO is celebrating over 67 years of designing and manufacturing reliable, accurate, and dependable refractometers for winemakers, vineyard owners, and grape growers. Digital hand-helds and benchtop models are available for the vineyard or quality control lab.



ATAGO's "Pocket" PAL-1 is perfect for field use. Ergonomically designed for one-hand operation and small enough to fit in a pocket, it quickly and accurately measures the Brix % of grapes. Widely used in the wine industry, the PAL-1 features a digital display, automatic temperature compensation, and full-body water-resistant design.

For lab use, ATAGO offers the highly accurate RX-5000alpha (+/-0.03% Brix) with a full Brix range from 0.00 to 100.00% and an internal Peltier thermo module that controls the temperature of the sample, thus eliminating the need for an external water bath. Other useful features include a history function, and an intuitive two-button operating system that saves the operator much valuable time when taking many sample readings. In recent seasons, the RX-5000a is fast becoming a versatile and efficient addition to winery labs around the world.

For quality wines, use a quality ATAGO refractometer. In the field or in the lab, ATAGO offers ease of use and industry-renowned reliability.

For more information, contact:

Atago USA, Inc.

12011 Bel-Red Rd. #101, Bellevue, WA 98005

tel: 877/ATAGO-USA; fax: 425/637-2110

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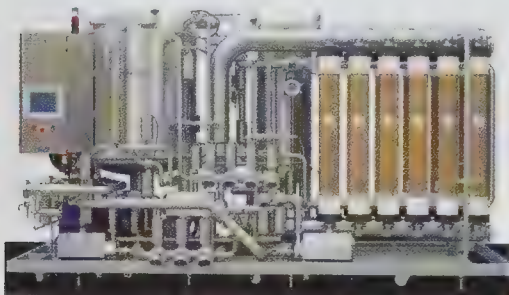
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OENODEV USA, INC.

OENODEV, the inventor of micro-oxygenation, is recognized worldwide as one of the most innovative and reliable suppliers of cutting-edge wine techniques and expertise. Established in 1990 in France, the company manufactures superior, time-tested MOx equipment and a range of the highest quality French oak chips. Each product is designed to deliver specific features to best suit the wine characteristics.



Micro-oxygenation is now proven as a viable alternative to traditional barrel maturation. VISIO6 is an unmatched micro-oxygenator with precise O₂ delivery, security backup features, and wireless control. It can treat up to 60 tanks simultaneously.

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- structure and body (SCA and DC310).

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Galina Seabrook

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Santa Rosa, CA 95401

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PWV READERS ARE INFORMED PROFESSIONALS

ONDINE CHATTAN

A busy woman. Chattan is Director of Winemaking at Geyser Peak Winery in Geyserville, CA, overseeing production of 330,000 cases annually, working with 225 acres of estate vineyards in Alexander Valley. She also is Winemaker for XYZin Wines.

A loyal reader. Chattan has been reading PWV for 12 years.

Why she reads PWV:

"For me, PWV is a must-read and frequent companion. The magazine provides up-to-date, progressive information about real winery and vineyard issues with an inquiring eye to the future. The no-nonsense approach, expert contributors, practical application, and varied approaches (from researchers to laymen) to subject matter, make it both reliable and exciting to read. The format often includes helpful diagrams and schematics to clarify subject matter, and the tone assumes an industry insider's level of knowledge to tackle the bigger issues. The voice of the magazine is informed and enthusiastic in pursuit of knowledge and improved wine quality."

Online's goals. "To produce inspiring wines, maintain exceptional quality, and increase production."



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So I've joined your winery ... now what?

Now that your winery has hired the perfect candidate, what can you do to make sure the individual produces the results that you're looking for? The most successful transitions for new employees are made when the winery has a well-crafted, structured orientation program.

There are three parts to a successful program: pre-arrival, on-board, and long-term.

THE FIRST "ORIENTATION" STEP AFTER A NEW EMPLOYEE IS HIRED IS TO SEND AN OFFER LETTER. The purpose of the offer letter is to welcome new employees and give them some important information. It should confirm their position title, salary (hourly for a non-exempt employee and bi-weekly or monthly for an exempt one), supervisor, and when/where to report.

The letter should also include a couple of "legal" items: an at-will statement, information about mandatory arbitration if that's part of your winery's policies, and any contingencies of employment — such as completion of an I-9, post-offer physical examination, drug screen, or DMV record check.

Many organizations send two copies of the offer letter, one for the employee to sign and return and one for them to keep for their records. Some companies also send an entire "New Hire Packet" with the offer letter, including information about the winery, an employee handbook, health benefits information, and copies of required brochures on workers compensation, sexual harassment prevention, disability insurance, and paid family leave.

It's also a great idea to call the new employee to confirm the start date and time, and provide any other necessary information, such as where to park or an overview of the dress code.

PREPARE FOR THE NEW EMPLOYEE'S ARRIVAL. The new employee's first day should be a positive experience that gives him or her an opportunity to feel useful and productive. A tall order? When a new employee has come from being a successful contributor in one environment to being a "newbie" at a new place of employment, it can be quite disconcerting.

It is useful to have a formal process for the morning of the first day, including a welcome meeting with the supervisor, introductions to key staff and co-workers, and a tour that ends at the employee's work area.

Some wineries identify an experienced "buddy" who can give the new employee a specific assignment that can be completed during the afternoon of their first day. This could be a specific task that the employee could learn and then perform, or it might be reviewing information or a report and commenting on observed trends. The point is to provide an

opportunity for the new person to make a contribution as soon as possible.

At the end of the day, make time to gather feedback from the employee about the assignment. In addition to providing time for a new employee to share their thoughts, during this session you can learn a lot about how the employee deals with ambiguity of a new task, how quickly they learn, and what additional support they may need to become fully functional.

CREATE A THOROUGH ORIENTATION SCHEDULE. For most positions, the orientation process will take more than one day. Developing a checklist and schedule will ensure that all the items are covered and will provide structure for the initial days or weeks of the new hire's employment.

Here are some topics that should be covered:

- Set up meetings with individuals who are key to the new employee's success, such as managers, distributors, peers, owners, etc.
- Review the winery's mission, vision, and culture.
- Provide information about the relationship between the employee's position and others in the department, the winery, and (for some positions) individuals outside the organization.
- Review current, 90-day, six-month, and one-year expectations for both performance and behavior.
- Review how feedback will be provided.
- Describe customer service expectations.
- Review the employee handbook and explain applicable policies and work rules, work schedules, time away from work, and benefits programs.
- Ensure that the employee is trained on safety and emergency procedures.
- Schedule technical training and wine education as necessary.
- Review pay policies and schedule.

CLARIFY EXPECTATIONS FOR THE FIRST SIX MONTHS: It is critical that the new employee understand your expectations and how to achieve them. The most successful wineries have established a formal process for this discussion.

The first step in this process is for the supervisor to clearly define two or three goals to be completed in the initial six months of employment. The definition should meet the SMART criteria: Specific, Measurable, Attainable, Relevant, Time-specific.

The second step is to have a conversation about these goals, including:

- How the goals relate to broader departmental or winery initiatives,
- Historical information about what's been done before and any obstacles that may get in the way,
- Resources available and how to access them,
- Other departments and individuals that may be impacted and how best to keep them informed,
- Status reporting and other communication requirements.

The final step is to establish a schedule for periodic check-in meetings for feedback and possible course corrections.

PERSONNEL POINT OF VIEW

CONDUCT A "NEW MANAGER ASSIMILATION" FOR NEW SUPERVISORY STAFF: The New Manager Assimilation process is used by many organizations to "jump start" communication and trust between a new supervisor and the staff. The process is made up of a series of meetings that are facilitated by an experienced third party, typically a consultant or the human resources manager. Because the process begins with a confidential meeting with the staff, the person selected to facilitate the process should be someone that staff members trust to be objective and confidential.

At the first meeting, the staff works with the facilitator to answer a series of questions, such as: What do you want to know about the new manager? What would you like the new manager to know about you? What challenges are currently facing the department? What concerns do you have about the transition to a new manager?

The facilitator then meets with the new manager, shares the questions and answers from the staff, and helps the manager prepare for a debrief session. The final meeting is a debrief with the staff, conducted by the new manager. The facilitator attends to provide continuity and to support the process. Often this final meeting evolves into a problem-solving and planning session for the team.

MAKE THE NEW HIRE ORIENTATION AN IMPORTANT PART OF YOUR WINERY'S HUMAN RESOURCE PRACTICES. Successful wineries take a long-term view of the new hire orientation

process. They ask for feedback on the program from participants and supervisors. Participants can offer suggestions to improve the process and validate the timing of content delivery. Supervisors can tell whether information was used on the job.

Another area of evaluation can be the bottom line effect on turnover, skills training time, or employee satisfaction. In fact, a recent nationwide survey found that 82% of the responding businesses rated orientation programs as "somewhat effective" or "very effective" in retaining and motivating employees.

To be effective, the orientation program should be viewed as a process, not an event, and carefully planned to welcome new employees, gain their commitment to your company, and communicate your expectations for them.

Elbert Hubbard, the American writer and philosopher said, "The best preparation for good work tomorrow is to do good work today." Spending time creating and implementing an orientation program will ensure that your new employees do good work for you from day one. ■

Anne Heron is a senior associate with The Personnel Perspective, a human resources consulting, training, and recruiting firm in Santa Rosa, CA. Anne has over 25 years of management and HR experience. You can contact her at 707/576-7653 or anneh@personnelperspective.com.

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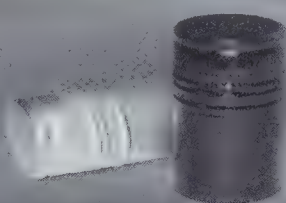
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Mendocino

With the benefit of Mendocino grapes

In our last edition, you heard from some of our most experienced growers. Now in their own words, these five, very experienced Mendocino winemakers share their knowledge about the quality of Mendocino grapes. Specifically, they put forth their thoughts on some of our main sub-appellations and growing regions.

Mendocino County is a transitional area.

The most significant factor influencing our grape quality is that we are situated between the Pacific Northwest and the Mediterranean climate of California. Because of the mountain (almost 60% of the County is covered with coniferous forests) and valley terrain, micro-climates are highly variable. Anderson Valley is the coolest wine growing area. Potter Valley, Yorkville Highlands and Redwood Valley are intermediate in warmth. Hopland, Sanel Valley and the Ukiah Valley are the warmest regions.

To view or download 2007 Harvest

Opportunities - a guide to our grower member's grape offerings, please see:

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Or for more info: (707) 468-9886

Top Mendocino Varietals

Whites	Acres*
Chardonnay	4,336
Sauvignon Blanc	786
Gewürztraminer	218
Viognier	121
Pinot Gris	116
Chenin Blanc	101
French Colombard	85
White Riesling	68
Reds	
Cabernet Sauvignon	2,559
Zinfandel	2,072
Pinot Noir	1,930
Merlot	1,853
Syrah	715
Petite Sirah	537
Carignane	423
Sangiovese	115
Barbera	70
Grenache	65
Cabernet Franc	60

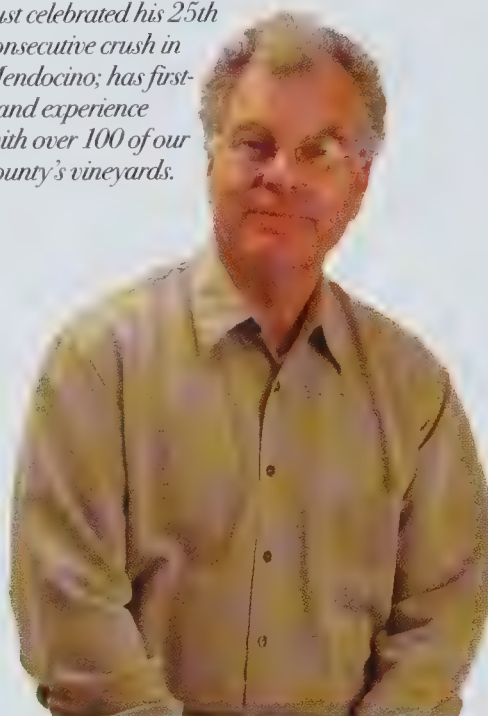
*Varietals with over 50 acres planted.

Redwood & Potter Valleys can give the wine added complexity

by Dennis Patton

Consulting Winemaker.

Just celebrated his 25th consecutive crush in Mendocino; has first-hand experience with over 100 of our county's vineyards.



Mendocino is special to a winemaker because no other area gives you so many microclimates to work with. Huge soil differences, often only 100 yards apart, will make very different wines. Thus, you can add dimensions of complexity to any particular wine by simply using a few various sites.

Redwood Valley has many historic vineyard properties.

I've walked many vineyards here where grapes have been grown continuously for over 100 years. Standing in Redwood Valley, you notice that the mountains to the west have a lower gap separating the ocean from the inland area. This tends to bring cool, late afternoon breezes, and the nighttime temps drop

rapidly, causing the fruit to ripen a week or so later than one might normally expect. The same is somewhat true in Potter Valley where I've noted that we've harvested Riesling at the same time as Anderson Valley, which has a much stronger maritime influence. I can't imagine ever working without Mendocino fruit. One of my fondest memories is one particular crush that included fruit from 58 different Mendocino vineyards! So one could say my secret weapon for wine complexity is utilizing multiple Mendocino vineyards.

Mendocino Ridge is sometimes called "Islands in the Sky"™

by Van Williamson

Winemaker, Edmeades.

Began his Mendocino grape love affair in 1984; makes wines without adding yeast, nutrients, or acid to allow the vineyard's terroir to express itself.



Mendocino Ridge is a fairly new American Viticultural Area but has some of the oldest producing vineyards in Mendocino County. First plantings were from Italian immigrants homesteading in the late 1800s. So there's more than a century of memories stored in the vines' ancient roots. Zinfandel was the variety back then, but now new plantings of Zinfandel, Pinot Noir, Syrah, Merlot, White Riesling, and Chardonnay also dot the ridge-tops.

Vineyards perched at 1,200 ft. or more in elevation are above the fog, and bask in the early morning sun.

Early afternoon breezes cool down the fruit, never allowing the temperatures to rise as high as the valleys below. The grapes always seem to have a slow start compared to others in the county, but they shift into overdrive in the fall and catch up with warm nights and absence of fog. The color of the fruit crushed from Mendocino Ridge has a fluorescent hue that is unique to the ridge-top vineyards. Mendocino Ridge grapes produce wines intense in fruit, high in acidity and structured for aging a long time in a cellar.

Grapes with lower nitrogen levels...

I've learned over the years how these hillside and ridge-top vineyards produce lower nitrogen levels in musts and ferment less vigorously. As a young winemaker, I would add nutrients and a commercial yeast and watch the fermentation roar. My winemaking style evolved to minimal intervention allowing fermentations to be sluggish and producing wines aromatically and texturally better.

MAIN APPELLATIONS & GROWING REGIONS

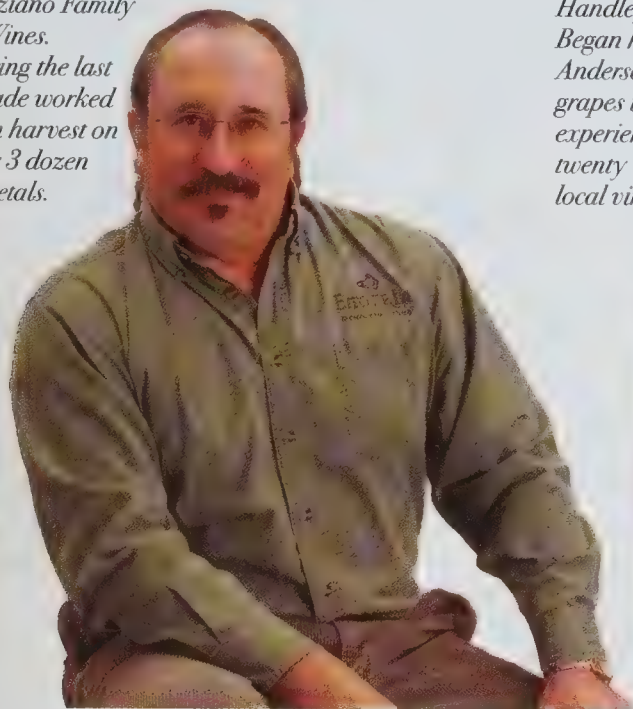
(Others: McDowell Valley, Cole Ranch, Covelo and Dos Rios)



our combined 127 harvests, here's why consistently make world class wine.

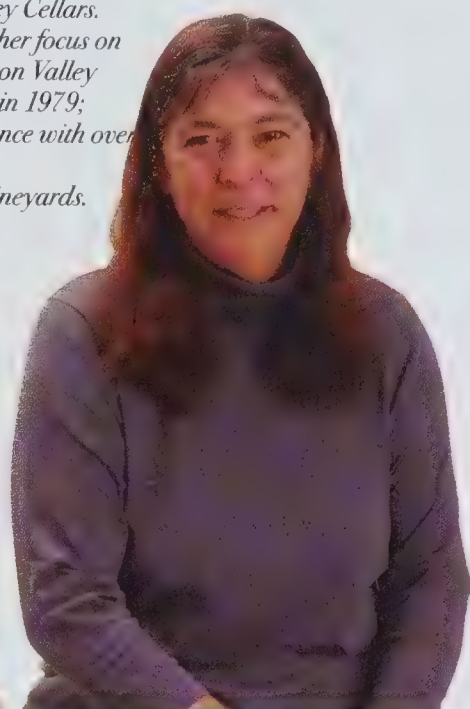
Yorkville Highlands – hillside soils between two famous valleys

by Gregory Graziano
Proprietor/ Winemaker
Graziano Family
of Wines.
During the last
decade worked
each harvest on
over 3 dozen
varietals.



Anderson Valley is one of California's coolest growing areas

by Milla Handley
Winemaker & General Partner
Handley Cellars.
Began her focus on
Anderson Valley
grapes in 1979;
experience with over
twenty
local vineyards.



Many inland valley vineyards are near the Russian River headwaters

by Robert Blue
Winemaker, Bonterra.
Last year crushed fruit
from 19 vineyards in
southern Mendocino
involving 15 different
grape varieties;
focuses on certified
organic fruit.



As I approach my 30th harvest of Mendocino grapes as winemaker, several things come to mind about what makes our grapes so special. Because of our unique position on the North Coast, we are the most northerly of all the major wine growing regions in California.

Our proximity to the ocean and its effects has a great, positive influence on the quality of our wine. Because we are at the headwaters of several of the most important rivers in the North Coast, specifically the Russian River, many of our vineyards are at higher elevations, which increases the sun ripening of our fruit but at the same time has a cooling effect on our grapes. As a result of all these factors, our grapes and wines possess high amounts of tartaric acids and lower amounts of malic acid, which produce wines with very fruity aromas and flavors and a great balance of acidity.

Yorkville Highlands - hillside, low vigor soils between two more famous valleys.

The Yorkville Highlands AVA sits between the more famous Anderson Valley to the northwest and the Alexander Valley to the southeast. Most of the 22 vineyards are situated between 1,000 and 2,200 ft. elevation with southern exposure and enjoy warm days but cool nights in the summer. Vineyard owners have planted 85% of the acreage to red varietals. I'm happy to have worked with Yorkville Highlands fruit for 16 years.

© Mendocino Winegrape and Wine Commission, 2007.

I believe that, unlike most of the rest of our county, the Anderson Valley is very tightly defined – physically and in climactic terms. Much of our valley is less than a mile across with 1,000+ ft. mountains on both sides. Being less than ten miles from the coast means we are very limited as to what varietals are best suited. Traditionally, we've grown Chardonnay, Pinot Noir, Gewürztraminer and Riesling; however more recently Pinot Gris, Pinot Blanc, Syrah and Muscat plantings have been added.

A winemaker's maternal role.

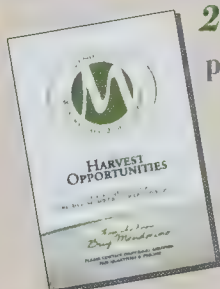
My goal is not to overwhelm the fruit, so it will reflect the varietal, the place and the vintage. However, it is my maternal role to elevate and refine the wine while not losing its core essence.

For 18 years, I have had the opportunity to make wines from the Ukiah and Sanel Valleys – From the Chardonnay grapes grown in vineyards just a stone's throw from the Russian River to dry farmed Zinfandel grown on steep Mayacamas Mountains. I've come to appreciate how gentle the weather is. **Sanel Valley grapes are truly ripe with sunny flavors.** So depending on the grape variety, I consider the sunny flavors to be peaches, blackberry, honeysuckle, lemon and Fuji apple versus the characteristics of honeydew melon, kiwi, grapefruit, strawberry and Granny Smith apples. I keep winemaker inputs to a minimum and really focus on freshness and balance in all the wines and let the natural qualities of our little valley do the work.

2007 Harvest Opportunities Guidebook

To view or download

2007 Harvest Opportunities - a guide to our grower member's grape offerings,
please see: www.MendoWine.com



Or call (707) 468-9886 and we'll mail you one.





Consumer wine preference and vineyard management

Understanding consumer preference is the new rage in Australian wine research. When I first heard of it, I thought this was a nebulous concept and that there was likely to be such great variation between consumers that it would be difficult to study. The Australian Grape & Wine Research & Development Corporation has committed considerable funds to study this topic in key export markets, with the expectation of finding some "magic bullet" to increase wine export. As part of this effort, the Australian Wine Research Institute (AWRI) has begun to study the same topic in Australia's market.

Consumer preference is of interest to me because of my involvement in "winemaking in the vineyard." After all, if other viticulturists and I claim to be able to manipulate wine quality in the vineyard, then studies of consumer preference will be useful to help us determine which attributes to enhance and which to suppress through our vineyard management efforts.

A recent study with red wines

A recent paper by Kate Lattey and other AWRI staff, published in the *Australian & New Zealand Wine Industry Journal* (volume 22, pages 31 to 39), was a very detailed study of consumer preferences for red wine quality, using both Cabernet Sauvignon and Shiraz (Syrah) varieties.

A set of 20 commercial red wines was chosen for the study, consisting of 10 Shiraz and 10 Cabernet Sauvignon wines. These wines were representative examples of the major wine types made in Australia. They included peppery, cool climate Shiraz, herbaceous Cabernet Sauvignon and wines with riper styles, with strong oak influences, with Brettanomyces, and with some sweetness, as well as less flavorful wines, and astringent wines. Consideration was given to the chemical composition and sales performance in selecting the wines for study.

Wine preference testing

The 20 wines were subjected to sensory descriptive analysis by a trained panel at the AWRI. From this data, a subset of 12 wines was selected for further study. Consumer studies were carried out in Sydney, Australia, with 203 persons chosen to represent the demographics of the wine drinking population.

Many of the consumers studied had been drinking wine for 20 years, and the most frequent price bracket for purchase was \$7 to \$12 US. The majority of the consumers drank wine three to four times each week. Interestingly, a survey of the group showed that only 22 persons could correctly identify a "corked" wine, and 81 consumers believed that corked wine results when the cork leaks and allows oxygen to spoil the wine.

Results of the consumer preference testing were very interesting. Generally, all wines were liked, with leading scores above five on a nine-point scale. However, there was consider-

able variation between consumers and no systematic pattern of liking between the Cabernet Sauvignon and the Shiraz wines.

The two most preferred wines were a Shiraz and a Cabernet Sauvignon. These two wines have different sensory profiles and different retail prices. The preferred Shiraz wine is one of Australia's top-selling wines, retailing for \$7 US. It contains significant residual sugar. The other preferred wine, a Cabernet Sauvignon, is produced by a medium-sized company and is not a market leader, selling for about \$17 US.

Common sensory features of these two preferred wines were lower ratings for *color intensity*, *hotness*, *astringency*, *Band-Aid* (Brettanomyces), *pepper*, *acidity*, and *bitterness*, and moderately higher ratings for *confectionery* and *floral*.

The least preferred wines included two wines strongly affected by Brettanomyces and a "peppery" (cool climate) style Shiraz. There appeared to be no consistent trend with alcohol level and preference, although the most preferred Cabernet Sauvignon wine had the lowest alcohol.

Enologists' preferences

Ten of the 12 wines shown to the consumers were presented to a group of 30 enologists and sommeliers at the AWRI. The preference patterns of the enologists were very different from the consumers. The two wines most preferred by consumers were not scored highly by the winemakers, though the winemakers also scored the wines affected by Brettanomyces lowest.

Summary of the preference testing

There was no significant correlation between the two sets of scores for winemakers and consumers, and the enologists' and consumers' preferences both showed considerable variation within their groups. These are interesting outcomes. The least preferred wines were higher in attributes of *bitterness*, *pepper*, *smoky*, *Band-Aid*, *barnyard*, *vegetal*, *earthy*, *metallic*, and *hotness*. Obviously, Brettanomyces contamination should be avoided. Attributes of the wines most preferred by both groups were *floral*, *confectionery*, *caramel*, *vanilla*, *coconut*, *red berries*, *overall intensity of fruit flavor*, and *dark fruits*.

What does this have to do with vineyard management?

Given the high variability of preferences by both consumers and enologists, it does seem that almost any lot of grapes will make a wine that someone appreciates. Perhaps this view may be seen as excessively cynical, but the fact that people are so variable in their preferences should not be forgotten.

The AWRI study provides some useful generalizations regarding the attributes of desirable and undesirable wines. In general, fruit flavors were identified as desirable. How can we improve the "fruitiness" of wines as we grow the grapes that make them?

For many white grape varieties, the answers are clear — moderate fruit exposure encourages fruit flavor; I am less sure of the situation for red wine grape varieties. However, my experimental work with Cabernet Franc in New Zealand shows that an open canopy with moderate fruit exposure does result in wines with more fruit character. My observation of vineyards worldwide reinforces this. I have yet to see a shaded canopy with poor fruit exposure that makes a fruity wine.



Cabernet Sauvignon on V-trellis with dappled light in fruit zone.
(Photo by Bryan Rahn)

In my opinion, fruit exposure is essential to producing red wine with desirable fruity characters. I recognize, of course, that excessive exposure of grape clusters to the sun in hot climates can have detrimental effects. It goes without saying, for optimum development of fruity characters in the grape berry, the variety should be grown in an appropriate climate that is neither too hot nor too cold for its physiological requirements.

Fruit character is present at low to moderate levels of sugar, so there is no need to harvest grapes at excessively high sugar content to achieve fruity flavors. This means that the wines need not be excessively alcoholic. In my travels, I hear and read of consumer rejection of high alcohol wines. While these still may be favored by some wine judges in the U.S., I doubt that those judges speak for the majority of consumers.

What of the undesirable attributes revealed in this study? The Sydney consumers did not like the peppery - style Shiraz that is produced in cool climates. Such notes are also apparent on the best wines from the Rhône Valley in France. One wonders if this consumer preference may change when consumers come to learn that this is a valid and even desirable attribute of Shiraz wines.

Consumers reacted negatively to vegetal characters in the wine. For many varieties, especially Cabernet Sauvignon, we know that such characters are associated with vigorous vines and shaded canopies. The solution to this is clear. Consumers also found 'hotness' undesirable, and this feature is associated with high alcohol in the wine. The solution is to harvest earlier at lower sugar levels.

Conclusion

The AWRI study reinforces my opinion that consumer preferences are difficult to determine because of variation among consumers. I was impressed that the wines the enologists preferred were not the same ones consumers chose. While this might be understandable, let us hope the enologists are making wines for consumers and not for their own consumption.

Several of the attributes preferred in the study, including some most significant to consumers, are due to manipulations in the



Sangiovese with desirable, open Smart-Dyson trellis in Shandong province, China. (Photo by Richard Smart)

winery rather than in the vineyard. Brettanomyces contamination was the attribute least preferred by consumers and wine-makers, and is clearly to be avoided in the winery. And while enologists may not wish to acknowledge this, it is evident that the winery practice of retaining residual sugar is pivotal to consumers' preference for red wines, and that may be the most important finding of this study. I am aware of red wines in both the U.S. and Australian markets with strong consumer following that have this feature.

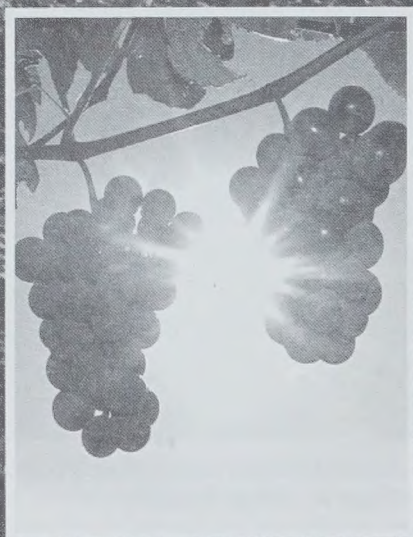
Fortunately, the study also provides some clues as to how we might manipulate vineyards to improve wine quality from the consumer's perspective. In my opinion, the study shows that moderate fruit exposure should be encouraged as a way to enhance the desired fruit flavors and discourage vegetal characters. (In saying this, I must reiterate my strong opposition to excessive leaf removal, which is practiced in California and now in New Zealand, and which I believe is detrimental to grape ripening and wine quality.)

In conclusion, such studies are helpful to tell us how to make wine to please consumers. In addition, these preferences can be linked back to wine sensory attributes, and to some extent to wine chemical composition. Then we can look at our vineyard management to see how positive attributes can be increased, and negative ones decreased. Frequent readers of this column will not be surprised that I suggest canopy management procedures to achieve these goals, but such is the effect of this powerful tool! But the sting is in the tail — the enologist can have an overriding influence by the amount of residual sugar retained in the wine. ■

Dr. Richard Smart, "the flying vine-doctor," is an international viticultural consultant based in Launceston, Tasmania, in Australia. He can be contacted by e-mail: vinedoctor@compuserve.com. Read about Dr. Smart's business, including his consulting schedule, educational wine tours, and seminars, at his home page <http://www.smartvit.com.au>. He visits America frequently and his consulting schedule is arranged by Vinquiry in Windsor, CA, tel: 707/ 838-6312 and <http://www.vinquiry.com>.

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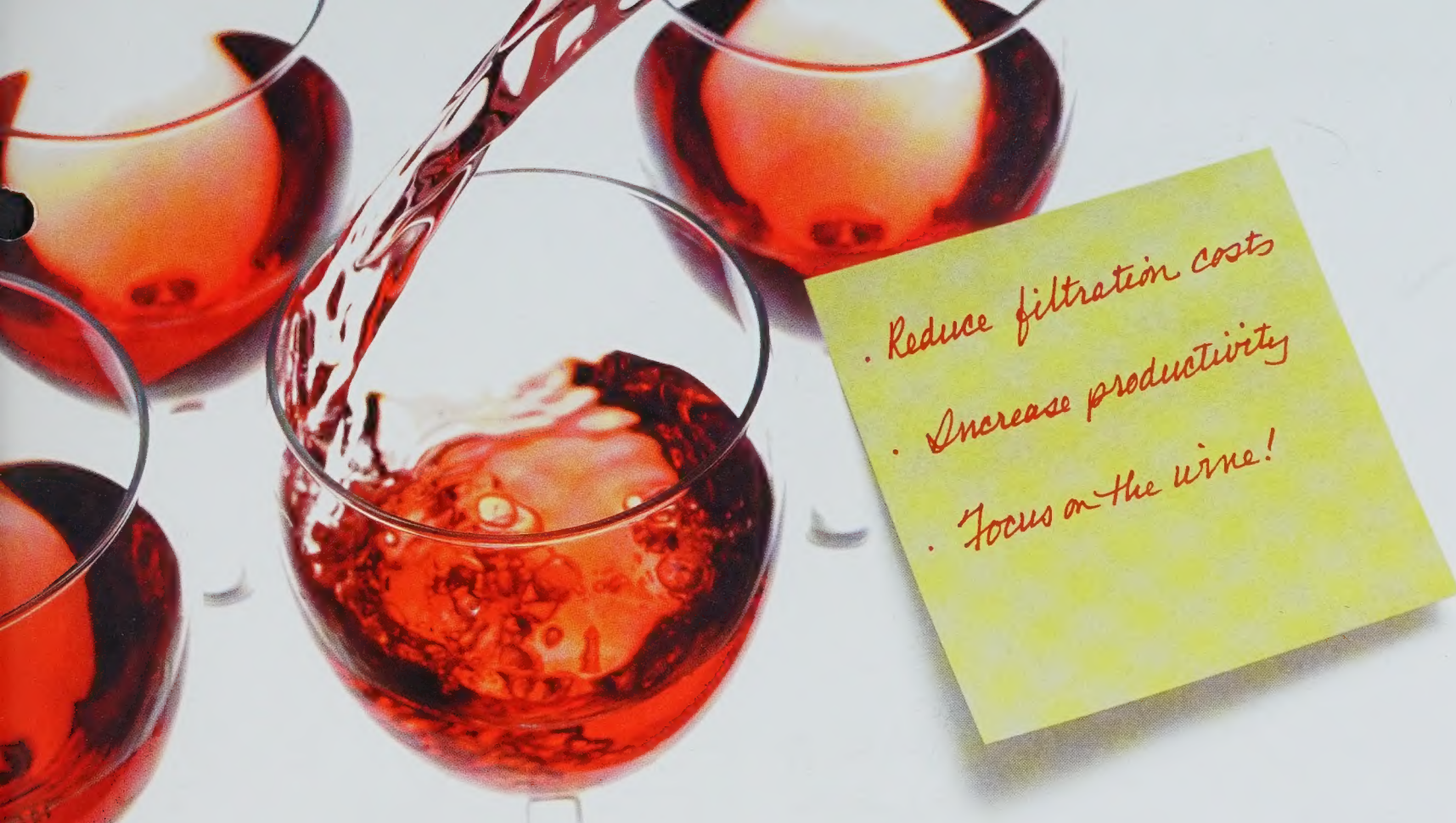
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